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ANTENATAL AND POSTNATAL CARE

By

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FOURTH EDITION

WITH 84 ILLUSTRATIONS



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1947

To the Memory of
my late chief and friend
John William Ballantyne
Pioneer in Antenatal Pathology
and Antenatal Care
this book is dedicated
in grateful remembrance of many kindnesses

A comely offspring she shou'd raise,
From sickness free, of lengthen'd days .
Plato Republic

<i>First Edition</i>	.	.	1935
<i>Second</i>	„	.	1937
<i>Third</i>	„	.	1939
<i>Fourth</i>	„	.	1942

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PREFACE TO THE FOURTH EDITION

THE book has been revised throughout. This made necessary the addition of about seventy pages of new matter yet it has been found possible to lessen the size of the volume by thirty pages. This has been done by drastic pruning and cutting out dead wood by the excision of Chapter II (The Clinic Room and Its Equipment) which too much resembled an instrument catalogue and of some matter in the appendix and by transferring the Bibliography formerly at the end of the book to the end of each chapter—a change that had been more than once suggested by friendly critics and which by allowing titles of articles to be omitted saved thirteen pages.

While revision has been general the new matter has been added chiefly in the chapters on Unsuccessful Pregnancy where a full account has been given of hormonal deficiencies as they affect that unfortunate event, on Vomiting of Pregnancy in which full consideration has been given to the recent contributions to the Pathology of Hyperemesis by H. L. Sheehan and on the Toxæmias of Late Pregnancy, where have been included especially a fuller account of Endocrine Factors as they bear on ætiology and the lately published observations of the author and Gladys H. Dodds on pregnancy in the patient with chronic hypertension. A short account which I owe to Miss V. Cynax has been given of the methods of preventing and treating by physical therapy stress incontinence following childbirth. Throughout the book in deference to modern trends greater emphasis has been laid on radiological methods in obstetric diagnosis and prognosis.

Acknowledgments are due to many friends for valuable criticisms and suggestions. For reading the first proofs I am indebted to Miss Gladys H. Dodds. As to illustrations I have to thank Mr C. H. G. McAfee for Fig. 23 for permission to reproduce already published illustrations I am indebted to the following: Professor Chassar Moir for Figs. 12, 13, 14 and 43, Dr. Glen Liston and Cruickshank for Fig. 64, Dr. Herbert Thoms for Fig. 82, and Mr J. V. O. Sullivan for Fig. 84.

Finally, it is a pleasure to express again my thanks to Mr J. Rivers of Messrs J. & A. Churchill for his constant courtesy and consideration.

F. J. BROWNE

LONDON

PREFACE TO THE FIRST EDITION

If any excuse were wanted for writing this book it might be found in the growing importance of the subject with which it deals, and the inadequacy of its representation in obstetric literature. It is the fashion to-day to decrie ante natal care and to charge it with having failed in its purposes. This criticism is fully dealt with in the text, and it is only necessary to say here what is well known to all who have given serious thought to the matter, that if antenatal care has failed it is not because it is inherently useless, but because it has comparatively seldom been given a chance by being properly practised. In many clinics its value has been convincingly demonstrated, and what has been done by a few can be done by all. At the same time, never has there been such a demand for instruction in the more recent advances in antenatal care and in the methods used in its practice, and it is hoped that the following pages which epitomise the teaching in a large modern clinic may help to meet this growing need.

In order to keep the volume within moderate size, pathological considerations have been reduced to a minimum and have only been introduced in so far as they are necessary to render intelligible clinical features and treatment. Dogma too, has little place, and the book will have largely failed in its purpose if it does not, in addition to conveying practical instruction, stimulate investigation, and indicate where knowledge is lacking, and where practice is based on empiricism or tradition rather than on sound scientific principles.

It is a pleasure to acknowledge my indebtedness to all those who in various ways have helped to make my task easier and the result more valuable and complete, to my friend Granthly Dick Read for writing the chapter entitled 'The Influence of the Emotions upon Pregnancy and Parturition', to the Dean and Medical Committee of University College Hospital for permission to publish the diet sheets in Appendices F and F to the Controller of H.M. Stationery Office for leave to reprint from the Interim Report of the Departmental Committee on Maternal Mortality and Morbidity the memorandum on 'Antenatal Clinics: their Conduct and Scope', to Professor J. C. Windever, of Sydney, for allowing me to reproduce Fig. 25 and Figs. 34 to 38 inclusive, to Drs. W. E. Caldwell and H. C. Moloy of New York and Professor T. Wingate Todd, of Cleveland, for Figs. 49, 50 and 51 illustrating pelves of known individuals from the Hama Museum of the Western Reserve University, Cleveland, Ohio, to Dr. S. H. Clifford of Boston U.S.A., for Fig. 31, to Dr. L. N. Reece for Figs. 32 and 33, and to Messrs. Mayer and Phelps for the loan of the blocks of Figs. 1 to 19 inclusive, and of Fig. 44.

For assistance in reading the proofs I am much obliged to Dr. J. D. S. Flew and Dr. Olive Browne. For kindly reading and helpfully criticising the chapters on 'Glycosuria and Diabetes' and 'The Anæmias of Pregnancy,' I am indebted to Dr. H. P. Hunsworth and Dr. John Boycott respectively. Dr. Gladys Dodds has throughout helped me in ways too numerous to particularise.

Finally, I must gratefully acknowledge the help in seeing the book through the press given me by Mr. J. Rivers, of Messrs. J. & A. Churchill. His constant courtesy and patience made the latter part of my task unexpectedly pleasant.

F. J. BROWNE

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ANTENATAL AND POST-NATAL CARE

CHAPTER I

THE HISTORY AND DEVELOPMENT OF ANTENATAL CARE

ANTENATAL care in its widest sense is no modern conception. Very few of the early writers on midwifery fail to make some reference to the care of the health of the pregnant woman or to the treatment of the diseases and disorders of pregnancy. Thomas Raynald in his "*Birth of Mankynde*," the English edition of which was first published in 1540, devotes an entire chapter to the ailments of pregnancy. François Mauriceau in "*Des Maladies des Femmes Grosses et Accouchées*" (1668) has several chapters (80 pages in all) on the hygiene and diseases of pregnancy. The woman is enjoined to avoid residence in narrow streets 'full of rubbish' for "there are women so delicate that the odour of a badly snuffed candle can bring about premature labour." Moderate sleep is recommended at least nine or ten hours and not more than twelve out of the twenty four and preferably during the night, "not turning night into day as is the custom with people who frequent the court." Monsieur Dionis in "*A General Treatise of Midwifery*" (1719) follows Mauriceau's work very closely. For vomiting he advises to think of 'some meat sauce or ragoo that will give a fresh appetite.' She must be allowed to choose her food and to eat whatever she has a fancy for. She may eat often, and at all hours and 'must not be tied down to meals.' William Smellie, in his first volume (1774) has two short chapters dealing with 'The diseases incident to pregnant women. These treat of such subjects as nausea and vomiting (which he ascribes to stretching of the uterus by the increase in size of the ovum affecting the nerves of that viscus especially those that arise from the sympathetica maxima and communicate with the plexus at the mouth of the stomach), hemorrhoids, costiveness, incontinence of urine, gonorrhœa and Lues venerea (which he evidently regarded as different stages of the same disease).

The first book solely devoted to antenatal care was "*Hints to Mothers for the Management of Health during the Period of*

Pregnancy and in the lying in room, with an Exposure of Common Errors in connection with these Subjects," by Thomas Bull The first edition appeared in 1837, and the twenty fifth, revised by Thomas Parker, was published in 1877. This edition consists of over 300 pages, and the latter half deals with the care of the child, The first five chapters are devoted to antenatal care Diet, "longings," regulation of the bowels, exercise, dress bathing, care of the breasts and nipples ("daily upon rising and going to rest each nipple must be washed either with green tea or the infusion of pomegranate bark, and having been carefully dried must be exposed to the air for eight or ten minutes and rubbed gently during this time with a piece of soft flannel If the skin of the nipple is very delicate and sensitive, and the above applications do not effect the object, a lotion consisting of 30 gr of sulphate of zinc to 8 oz of rose water may be substituted") heart-burn, cramps, etc There is an excellent discussion of maternal impressions under the title, "The supposed influence of the imagination of the mother upon the child in the womb," in which he brings forward the following conclusive argument "Why," he asks "should we be surprised at some irregularities on the skin and other parts of the human body since we see the same thing occurring daily throughout the animal and vegetable world? They have their moles, their discolourations, their excrescences, their unnatural shapes which it would not be very philosophical to ascribe to any effort of the imagination" He quotes a letter in the *Gentleman's Magazine* for October, 1774, from "an eminent and clever man" who thus writes to his patient "Those who have been attentive to their poultry will inform you that chickens are as liable to a preternatural structure of their organs as children Now the egg, in order to be hatched is placed under the hen, the heat of whose body gives nothing to the fluids which nourish the chick till it becomes sufficiently strong to break the shell, when it is produced with a claw extraordinary or any other preternatural appearance to which chickens are liable Now, in this instance the extraordinary claw, if we take this instance for our argument, must either have been formed in the moment of conception or have been added at some period afterwards, when we suppose the hen to have been under the influence of some powerful imagination If you grant that the chick was originally formed in this shape it follows from the rules of analogy that all preternatural births have the same cause If not, the fancy of

the hen must have operated through the shell to work the effect I flatter myself that this is too marvellous and absurd a notion to gain much credit from a woman of good sense If, however, you still have a secret persuasion that she may (in some wonderful manner, you know not how) while she is sitting affect the chick in the egg, so as to alter its frame, know for a certainty that eggs hatched in dunghills, stoves, and ovens produce as many monstrous births as those which are hatched by her, which should, I imagine, prove irrefragably that the chick is produced in the very shape in which it was formed "

Dr Ad Pinard (1878) discusses the dangers of malpresentations, especially presentation of the shoulder In 200 observations he found that malpresentations occurred seven times as often in multipare as in primigravidae The cause, he argued, could not therefore be congenital, as had till then been supposed, but lay in the state of the abdominal wall When the wall is normal it pushes the head into the pelvis in the last two months of pregnancy He advocated, in order to reinforce the stretched and weakened abdominal wall in multipare, the use of an elastic belt (an artificial abdominal wall) "In that way," he says, "I have always prevented presentation of the trunk I believe that one should examine in the last month of pregnancy to see if the child is accommodated if the presentation is good, or if bad to remedy it In a word, if in the last month the head of the foetus is not in the pelvic cavity it must be put there If one does not always succeed in doing so one can always correct a shoulder presentation "Women," he says, "are vaccinated that they may escape small pox, and they should be examined to avoid the risks of version for themselves and for their child' At that time the maternal mortality from version was extremely high, about 1 in 21 This is, I believe the first reference to the need for routine examination of the abdomen in pregnancy and correction of malpresentations and Pinard had evidently recognised, too, the dangers of the "floating head "

The next important paper is also by Pinard, and is dated 1895 In it he records the establishment, on the initiative of Mme Becquet, of Vienne (France), in the Avenue du Maine, Paris, in 1892, of the first shelter or refuge for abandoned pregnant women (*les femmes enceintes abandonnées*) deprived of help and protection whatever their social position or nationality Some time later the city of Paris opened l'asile Michelet in the rue de Tolbiac Pinard

to Ferguson and said that he had changed his mind and would be willing to take it over ' ¹

The Work at the Hôtel Dieu and Hôpital de la Salpêtrière

As is noted above Pinard referred to the establishment of Madame Becquet as the "first of its kind." This however is by no means correct even if his statement applied only to shelters for women illegitimately pregnant. A very full account of the work at the Hôtel Dieu is given by Tenon in his *Memoires des Hopitaux de Paris*, published in 1788. Tenon was professor of pathology at the College of Surgeons in Paris and gives a review with plans of the wards of the entire hospital accommodation available in Paris at that time. No one, he says, is more worthy of care than the pregnant woman who carries within her the support of empires and the germ of future generations. "All pregnant women who present themselves at the Hotel Dieu are admitted provided they have reached the end of the ninth month. Those who before that period wish a secret refuge find it at the Hopital de la Salpêtrière where a special ward is reserved for them alone. The strict rule for admission at the Hotel Dieu was as follows: 'All pregnant women who present themselves are admitted provided they have reached the end of the ninth month but exceptions are made in the following cases. Women some months or more pregnant who are ill, those fatigued by heavy work or by a long journey are also received at the seventh month especially when they have pains when the womb is very low and when at the same time the cervix is dilated. They were accommodated in two large wards comprising 67 beds in all but 43 of these beds were large (4½ feet wide) and had to accommodate two or three or sometimes four patients so that on account of the crowding many found it more comfortable to spend at least part of the night on a bench by the side of the bed. Little effort was made to separate sick from well patients. 'We must not suppose, he says, "that all the pregnant women are in good health. There are some with itch, some with venereal disease and a large number with fever and other maladies." Those suffering from itch had five places in three beds while the venereal patients had two places in a single bed 3 feet wide. Many of the sick occupied the same beds as healthy patients.

How long had this accommodation been available? On this

¹ Personal communication from Professor R. W. Johnstone, Edinburgh.

point there appears to be no definite information Tenon says,

A Paris de temps immémorial des Hôpitaux destinés aux accouchements ont été ouverts à la femme légitime à la femme dissolue et à cette infortunée qu'un instant de fragilité a rendu mère It is clear therefore that their admission goes back to long

before 1788 How Pinard could say that the refuge of Mme Becquet, established in 1892 was the first of its kind is difficult to understand unless he means that the refuge (l'asile) was different from a hospital If that is so most readers will agree that the distinction was a very trivial one and that in the establishments described by Pinard there was nothing essentially new

Nevertheless these two papers by Pinard mark the beginning of a new period in the development of the care of the pregnant woman Hitherto writers when they had referred to the subject at all had dealt with the treatment of the discomforts and diseases of pregnancy but only if we except some references to the treatment of the nipples in order to prevent cracking with diseases that were already established and that therefore could scarcely be ignored One looks in vain for any attempt at *prevention* as we understand it to day Pinard's papers mark the opening of a new epoch They are the first faint whisperings heralding the coming dawn that was destined to lighten the early years of the new century It is true that the refuges to which Pinard refers were open only to abandoned women and that these entered them only to receive food and shelter and to conceal their condition but none the less they received there routine care which was sufficiently enlightened and adequate to prevent eclampsia and difficult labour resulting from malpresentation There was yet however no attempt to secure the *routine supervision* of all pregnant women But such attempts were not to be long delayed

Dr J W Ballantyne

In 1901 appeared a paper by Dr J W Ballantyne of Edinburgh, entitled A plea for a pro-maternity hospital In this Ballantyne deploras the fact that in spite of noteworthy advances in gynaecology and to a less extent in obstetrics but little progress had been made in our knowledge of the pathology of pregnancy There was still much ignorance of the real nature of eclampsia of hyperemesis gravidarum of hydramnios of hydatid mole and of most of the idiopathic diseases of the foetus and progress was much

hampered by absence of reliable information "concerning the physiology of pregnancy and more especially concerning the physiological chemistry of pregnancy" "The question may now be fairly asked if we in the twentieth century are going to be contented with the knowledge (or ignorance) of the nineteenth in these matters The pro maternity hospital might quite well be an annexe of the maternity . it will be for the reception of women who are pregnant but not in labour "

There can be no doubt that the appearance of this paper marked another important forward step in the development of antenatal care Hitherto, with the exception of the accommodation in the Hotel Dieu, women suffering from one or other of the diseases of pregnancy had been admitted, not into maternity hospitals but into the wards of general hospitals, where they were under the care of practitioners in general medicine, who might or might not be interested in the diseases of pregnancy Their admission was often only secured after considerable difficulty, they were discharged at the earliest opportunity, for births in the wards of a general hospital are always unwelcome, and, few of the general physicians having any interest in the physiology or pathology of pregnancy, little or no effort was made to carry out any investigation that might further knowledge of these subjects The provision of prematernity beds in maternity hospitals was certain to give a fresh impetus to, and enhanced opportunity for, these important studies

It is, I think, clear that Ballantyne had in mind at this time, as the chief purpose of the pro maternity hospital, the advancement of antenatal therapeutics in the interests of the foetus and child, for he says, "The idea of a pro maternity hospital has been forced into my mind by several circumstances during the last few years, but more particularly by communications which I have received from medical men in various parts of this country and the United States In these communications the particulars of cases of antenatal disease and deformity were stated, and an opinion asked for with regard to possible plans of treatment In some I was able to give advice, in others I had little or nothing to propose, but in all I could not help wishing that I knew of a hospital where the case could be placed and scientifically investigated " He gives as examples a case of repeated abortion, one of an alcoholic mother who had given birth to an infant with congenital heart disease, a hæmophilic mother who had given birth to two hæmophilic male

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infants and the case of a woman, "truly a monstipara," who had brought three monstrous infants into the world and had had several abortions. In all this paper there is no mention of the interests of the mother. Ballantyne's work up to that time had been chiefly concerned with antenatal pathology, and his two classical volumes on this subject had just been published. He was lecturer in Antenatal Pathology and Teratology in the University of Edinburgh, and in that capacity had given, in February and March 1899, a series of six lectures on these subjects. In 1900 two lectures on 'Antenatal Diagnosis' were published. In all these attention is directed almost exclusively to the diagnosis of morbid states in the fœtus and to therapeutic measures meant for their prevention. "Antenatal diagnosis," he says, "includes the discovery of normal pregnancy and of plural pregnancy, of fetal death, of diseases and monstrosities of the fœtus, of hydramnios and of morbid conditions of the placenta. All these matters must be kept in mind in examining a patient who may be pregnant and in all of these there is at any rate an increasing probability that the diagnosis may be thoroughly well established under favourable circumstances and with reasonable care and skill." The same remarks apply to his paper, "A Visit to the Wards of the Pro-maternity Hospital—a Vision of the Twentieth Century" (1901). The article is headed, "There is a fall in the birth rate, and this gives the clue to its contents, and still more to its purpose. In order to compensate for the falling birth rate, which he foresaw as one of the pressing problems of the twentieth century, he imagines a pro-maternity hospital established in 'Weissnichtstadt in the Alsace-Lothringen country between France and Germany' and with an international staff, the purpose being to 'prevent miscarriages and that most terrible of all events the dead birth, and cure before birth the diseases and deformities of the fœtus'."

The result of his "plea for a pro-maternity hospital" was the endowment by an anonymous donor, whom we now know to have been Dr. Freeland Barbour of Edinburgh, of a bed to be called the *Hamilton bed in memory of Dr. Hamilton, formerly professor of midwifery in Edinburgh*. The story cannot be better told than in Ballantyne's own words. "It was in July, 1901, that my hopes regarding the establishment of a pro-maternity hospital which had been drooping somewhat, were revived by the receipt of a letter from a friend who had all along thought well of the proposal.

This letter contained the welcome intelligence that the writer had given a sum of money (£1,000) to the Edinburgh Royal Maternity and Simpson Memorial Hospital for the endowment of a bed to be used for the treatment of patients suffering from the diseases of pregnancy. The bed was named the Hamilton bed in memory of Professor Hamilton, who had so much to do one hundred and ten years before with the founding of the Edinburgh Maternity Hospital (1791). In November, when Sir Alexander Simpson took over the hospital,¹ he was able to open the Hamilton bed by putting into it a patient suffering from hydramnios, and as I acted as assistant physician at this time I had an opportunity of superintending the four or five cases treated in it during the next three months. Here it may be stated that Ballantyne soon dropped the term "pro maternity" and substituted for it the word "pre maternity." He had used the prefix "pro" in its Greek sense of "before" or "in front of," not in its Latin sense of "in favour of." But he soon realised that the term was misleading and was in any case a hybrid word. He therefore adopted the name "prematernity," which more clearly indicated his meaning, and this term was in use for a number of years. The number of beds was soon increased to four and gradually to twenty five.

Whilst it would be absurd to contend that these were the first beds set apart for pregnant women, they were, I believe the first designed for the specific purpose of the study of the physiology and pathology of pregnancy and of antenatal therapeutics.

The Establishment of the Outdoor Antenatal Clinic

It is remarkable that during the first dozen years after the establishment of the "pre maternity" beds, there seems to have been no conception by Ballantyne of the outdoor antenatal clinic designed for the routine supervision of all pregnant women, normal as well as abnormal, which is such a commonplace feature of obstetric practice to-day. This is all the more difficult to understand when we consider that there is no doubt that he was fully aware during these years of the advantages to both child and mother to be gained from such routine supervision. In his address on "The Future of Obstetrics," delivered from the Presidential Chair of the Edinburgh Obstetrical Society in 1906, he

¹ There was at that time a rota of service at the hospital each physician's term of service lasting three months.

now dominated to a much lesser degree by his interest in foetal pathology than was the case six or seven years before and that the interests of the mother and the advantages that might accrue to her through antenatal supervision now occupied their rightful place a place equally important as though perhaps no more so than the conservation of foetal and infant life

The Contribution of the United States

It is evident from what has been said above, that Ballantyne while fully aware of the need for and the value of the careful supervision of pregnancy had at that time apparently no conception of the means by which this was to be brought within the reach of the bulk of the population who could not afford high medical fees but were dependent on the attention of a midwife or on the indoor or outdoor service of a maternity hospital in other words he did not advocate or foresee the establishment of the obstetrical out patient clinic or the antenatal clinic as we understand it to day Thus we owe largely to the United States of America where the new ideas concerning prevention in midwifery had fallen on fertile soil Particularly was this the case in Boston, where as early as 1901 the Instructive Nursing Association began to pay antenatal visits to some of the women in the out patient department of the Boston Lying in Hospital This work gradually spread until in 1906 all these women were paid at least one visit by a nurse from the association some time between the date of application to the hospital and the confinement of the patient By 1912 this association paid about three antenatal visits to each patient of the Boston Lying in Hospital out patient department

In 1909 Mrs William Lowell Putnam of the Infant Social Service Department of the Women's Municipal League of Boston began the experiment of intensive prenatal care of the patients registered at the Boston Lying in Hospital later to be confined in the hospital itself These patients were visited by the nurse every ten days and were not only instructed as to the proper care of their bodies but were reassured and encouraged as well This work was so successful and the need for it so clearly demonstrated that in May 1911 the pregnancy clinic of the Boston Lying in Hospital was opened for out patients ¹

¹ For this information I am indebted to Dr James L. neolin Huntington, of Boston who has drawn my attention to his article on the Relation of the

be given to the dangerous complications of pregnancy such as toxæmia, syphilis or heart disease.

(4) An increase in the number of normal labours and of normal pregnancies.

(5) The still birth rate will be at once lessened

TABLE I. *Incidence of Maternal Deaths from Puerperal Albuminuria and Convulsions.*¹

Year	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1938
Rate per 1 000 live or total births	0.71	0.63	0.72	0.70	0.75	0.82	0.81	0.78	0.69	0.57	0.58	0.61	0.60	0.56	0.53	0.44

(6) To use his own words, "one may confidently look for a fall in the maternal death rate, due to such obstetric complications as sepsis, hæmorrhage, embolism and the like, and to the operative interference which they call for."

We are here concerned with the extent to which these anticipated gains have been realised, the reasons why the results have been so disappointingly small, and the main lines along which we may reasonably look for improvement in the future.

It is a matter of common knowledge that the maternal death rate has not fallen materially. In 1911 it was in England and Wales 3.87 per 1,000 live births. In 1938 it was 2.97 per 1,000 total (live and still) births. The death rate from eclampsia has,

TABLE II. *Deaths under one year per 1,000 live births 1927 to 1938 from injury at Birth*

1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1938
1.85	1.00	2.10	2.10	2.11	2.25	2.28	2.33	2.36	2.53	2.59

however, fallen considerably (Table I.). Still births have only been notifiable since 1927 so that records are only available for

¹ The rates for these headings are per 1,000 live births up to and including 1927. From 1928 onwards they are per 1,000 total (live and still) births. The differences in the results are, however, so small that they may, for practical purposes, be disregarded.

eleven years. In 1927 the still birth rate was 38 per 1 000 total births since then it has remained almost constant and in 1937 was 31 per 1 000. Again although the mortality of infants under one year has fallen considerably the infantile death rate from birth injuries shows a steady rise. The rates from 1927 to 1938 inclusive are shown in Table II.

The chief reasons for this comparative failure of antenatal care would seem to be as follows —

(1) *Increased Frequency of Primary Births* That there should be an increase in the incidence of primary as compared with subsequent births would be expected in view of the fall in the birth rate. Apparently, however no statistics on the matter exist but information has been obtained from certain areas by the courtesy of their medical officers. These figures leave no room for doubt that the proportion of primiparae in the child bearing population has been increasing steadily in the last twenty years. As eclampsia, accidental hæmorrhage and difficult labours are more common in primiparae it may be assumed that here we have an important factor in maintaining the high maternal death rate. It is however, noteworthy that the mean age at marriage is the same now as it was forty years ago, namely 26.

(2) *Much Antenatal Care is Inadequate and Inefficient* Taking the country as a whole and considering the antenatal care given at state-aided clinics (in which 42 per cent of all expectant mothers of the country are cared for) as well as that given by midwives, private practitioners and hospitals it is probable that 80 per cent of all parturient women in England and Wales receive antenatal care of some kind or degree. Many of the most elaborate municipal schemes have however only been in existence for a year or so and could not therefore have yet affected maternal mortality. In one county for example there were in 1935 thirty four clinics as compared with six in 1930.

Imposing as these figures are there is reason to believe that much antenatal care is inadequate and inefficient. All who have to do with this work know how easy it is to become slipshod because abnormalities are comparatively rare. In no department of medicine is one so liable to drift into careless ways and thus to miss the occasional abnormality or the occasional sign of impending danger and against this the antenatal worker needs to be constantly on guard. Munro Kerr has emphasised this he says it is watchful care that is essential. The constant watch

fulness on the part of those in attendance tends to slacken as in so many cases nothing abnormal occurs

Much of that which now passes under the guise of antenatal care is unworthy of the name. Examinations are too infrequent too perfunctory and too unskilled to accomplish anything useful. I have shown, for example that many clinics in teaching hospitals are doing nothing to prevent eclampsia among their own patients for the incidence of eclampsia in the booked patients attending is as high as in the general population and yet we know that eclampsia is almost entirely a preventable disease and that in a few clinics it is being prevented. If this is happening in our training schools can we expect better at the hands of the general practitioner or midwife? Writing to me recently on this matter one county medical officer said. I am of opinion that the antenatal work at the institutions with which I am acquainted is extremely badly done. Far too much is undertaken by the resident medical staff and the consultants are rarely called in.

It is time we realised that antenatal work calls for experience and skill that patients must be individualised not only in regard to general hygiene and the maintenance of bodily health but also in regard to diagnosis and treatment and that in the antenatal clinic there should be no such thing as mass production. The success of a clinic should be judged not by the numbers passing through its books nor even by the number of attendances registered by each patient but only by its effect in securing normal delivery and in reducing maternal foetal and neonatal mortality and morbidity. It would be a great advantage if all medical officers gave such information in their annual reports as some already do. None of us is exempt from mistakes and failures but each failure or mistake should be an occasion for self examination and possibly for an overhaul of present methods.

We have seen that about 42 per cent. of expectant mothers are looked after in the municipal clinics. The medical officers of these clinics are almost always heavily handicapped by the fact that they do not attend the women during delivery and rarely get any information as to what happened at the confinement. It is thus impossible for them to check the quality of the supervision they have given, or to enlarge their experience by the valuable method of learning from their mistakes. Furthermore only about 25 per cent. of them have had post graduate experience as resident

if these operations were always safe, but we know they are not. I have shown, for example, that out of 173 deaths in nine maternity hospitals, all staffed by experts, 8 or 1 in 20, followed directly on induction, death being due to sepsis, hæmorrhage or anæsthetic complications. In addition to these 8, there were many others that followed indirectly. For example, induction by bag or tube for "disproportion" was followed ultimately by Cæsarean section and death from sepsis. As illustrating the danger of Cæsarean section even in the best surroundings it is only necessary to mention that recent published reports of eight teaching hospitals in this country record 44 deaths among their own "booked" and therefore supervised cases and of these 12 (27 per cent.) followed Cæsarean section in originally "clean" patients, the most frequent cause of death being general peritonitis. It does not help a woman very much if she is rescued from the hypothetical consequences of an abnormality but is killed in effecting the rescue, and this is what appears to take place. Neither does it seem to be an exaggeration to say that *antenatal care has often simply transferred mortality from one column to another*. Deaths from obstructed labour are now comparatively rare, but we have replaced them to some extent by deaths from preventive operations. The remedy lies in the realisation that even the best antenatal care does not abolish the need for good obstetrics and that it may even be dangerous unless supplemented by wise conservatism in treatment.

(4) *Increased Demand for Intervention, Anæsthetics etc.* It has been pointed out by Fairbairn that in 1924 and 1925 there was evidence of an increasing tendency on the part of the Queen Victoria Jubilee midwives to send for medical aid during labour. During 1924 in 13 per cent. of cases the doctor had been called in on account of difficulty or delay. In 1925 the frequency had risen to 17.9 per cent. I have obtained the figures for 1931, 1932 and 1933 and they are 20.1, 22.1, and 21.5 per cent. respectively. Although these figures refer particularly to the Queen Victoria Jubilee midwives it is probable that they give an accurate representation of what is happening in the practice of midwives throughout the country as a whole. Are we to put this down as Fairbairn does, to the midwives becoming less self-reliant, or may it not be due to a decreased capacity to bear pain, and to an increasing demand for rapid termination of labour and especially for anæsthetics?

Finally, it should not be forgotten that there is a certain proportion of obstetric complications some of them the most serious with which the obstetrician can be confronted, such as sepsis after normal labours and antepartum hæmorrhage, that antenatal care is so far powerless to prevent. These have been recently analysed by Strachan and details of them will be found in his paper.

The Future of Antenatal Care

What the future of antenatal care is to be it is possible at the present time only to conjecture. Will it pass more and more into the hands of the general practitioner or of the general practitioner and midwife with the obstetric specialist called in cases of difficulty or emergency, or will it with obstetrics generally, develop along the lines of a specialist service? Such master obstetricians as Munro Kerr and Miles Phillips among others, advocate a service of highly trained obstetric specialists who would be responsible for the midwifery service of the country. The "man midwife" of the future says Miles Phillips must have had "a special training in obstetrics and especially in surgical obstetrics." This will necessitate post graduate residence in a maternity hospital and the obtaining of a special diploma as evidence of proficiency in operative midwifery. The larger hospitals would be controlled by a resident master obstetrician and gynecologist. Under him will work a whole time staff of large experience who will be directly responsible for all major operations. They will also *control and supervise the routine work of the midwives*. In the smaller district and country hospitals it will probably be found necessary for a family doctor who is sufficiently interested in obstetrics to have qualified himself by special post graduate hospital experience to attend these patients with the co-operation of the highly trained resident midwives aided of course by a colleague when an anæsthetic is required. In other words, before *undertaking this responsible work* he will have to have gained experience and skill after graduation by a long period of residence in a maternity hospital and not as has been too long the case by striving to overcome the difficulties of domiciliary practice. Would this revolutionary change be such a grave hardship as some imagine? I doubt it. Many of my doctor friends have told me of their dislike for midwifery with its anxieties and exactions that they undertake as little as possible, and that only in order to benefit their general practice.' He goes on to quote the

letter of a general practitioner who suggests that 'the medical profession should organise its own midwifery on the following lines. Let the country be divided up into districts. In each district the general practitioners would agree to hand over all their midwifery to someone who wishes to specialise in this work and in gynaecology, and who in turn would guarantee to practise solely as a gynaecological surgeon and specialist in midwifery.

Neighbouring districts could combine to equip up to-date maternity and gynaecological hospitals. F W Lynch too in his Presidential address to the American Gynaecological Society says regarding the impossibility of training undergraduates to become experts in every branch of medicine 'why do we not license the physician to practise only in the departments in which he has had proper technical training and licence separately to practise in internal medicine and minor surgery, or in obstetrics and gynaecology or in major surgery? Such a change in medical licensure is bound to come forced by bad results in obstetrics, gynaecology and surgery in the hands of those with inadequate training unless the schools lengthen their clinical courses and train all their pupils in all the handicrafts of medicine.

Is it possible thus to circumscribe the practice of individual practitioners so that each shall deal only with branches of the healing art that are not incompatible with each other and in which he or she has had special training and experience? It will be observed that if this were done it would be but a return to the principles enumerated in the undertaking given by every medical graduand in the oath of Hippocrates. 'I will not operate on those who have stone in the bladder, rather will I leave it for those whose profession it is'. One thing is certain individual interests and inclinations must be subservient to the common good. And probably whatever reforms are ultimately found to be necessary in the public interest will in the long run be for the benefit of medicine itself and of those who practise it.

REFERENCES

- BALLANTYNE J W *Brit Med Jour* 1901 i 813
 BALLANTYNE J W *Trans Edin Obst Soc* 1906-7 3 33
 BROWN I J *Lancet* 1932 ii 1
 BROWN F I *Brit Med Jour* 1934 ii 101
 FAIRHAIRN J S *Brit Med Jour* 1934 i 47
 KERR J M MCMURDO *Maternal Mortality and Morbidity* Irvingstone
 Edinburgh, 1934
 PHILLIPS MILLS *Lancet* 1935 ii 1107
 STRACHAN G I *Med Press & Circ* 1934 188 123
 WHIGLEY, A J *Brit Med Jour* 1934 i 891

CHAPTER II

DIAGNOSIS OF EARLY PREGNANCY

THE diagnosis of pregnancy in the first three months may sometimes present considerable difficulty, and a discussion of the early signs may be found useful

Amenorrhœa This is usually the earliest sign, though sometimes morning sickness or breast discomfort precedes it. Amenorrhœa coming on suddenly in a patient whose menstrual periods were previously regular is most likely to be due to pregnancy. There are, of course, a few well known conditions that may cause sudden amenorrhœa, such as, for example, tuberculosis, change of climate, mental shock or worry, chills, etc., but these are comparatively rare and pregnancy should always be excluded before they are blamed.

Morning Sickness This may be the first sign of pregnancy, and not infrequently precedes amenorrhœa. Some women, however, never experience morning sickness, while in most its onset is postponed till one period or more has been missed. At first it may be no more than a feeling of distaste for food in the morning, and it may be simulated by gastric catarrh, or may appear in patients who fear pregnancy or greatly desire it.

Urinary Symptoms Quite early in pregnancy, often as early as the third week, there may be increased frequency of micturition during both day and night, the patient finding it necessary to get up once or even twice at night to pass urine, especially in the early morning hours. A large proportion, however, are not so troubled till after the third month and a few never suffer from night frequency at any time. The frequency of the early weeks may disappear for two or three months in the middle of the pregnancy, but often continues without any intermission. When the head sinks into the pelvis at the end of pregnancy night and day frequency are aggravated and there may be dribbling incontinence.

Breast Signs The earliest symptom in the breasts is a feeling of discomfort in the breasts themselves or in the axillæ, or in both. This may take the form of slight shooting pains and a sensation of fullness, and the breasts may be slightly tender. Many women, however, experience similar sensations just before a menstrual period. A very early breast sign is the appearance under the

skin of rather prominent blue veins, due to the increased activity and vascularity. About the end of the third month it may be possible to squeeze a little watery secretion from the nipples. This sign may also be present, however, if there are uterine fibroids or an ovarian cyst, or occasionally in the absence of any apparent cause. It is, of course, only of value in primigravide. Pigmentation of the nipples and areolæ only occurs during pregnancy. It is of value in diagnosis only in the primigravida and does not usually become well marked until the beginning of the fourth month. Montgomery's tubercles, the pouting lips of sebaceous glands, are present in the nullipara. In pregnancy they hypertrophy and become more prominent but as it is difficult to define the limits of their normal size, which varies in different people, this sign is of little assistance in the diagnosis of early pregnancy.

Vulval Signs Looking at the vulva and its surroundings one may find a few stellate veins, perhaps best seen on the extreme upper and inner part of the thighs, close to the posterior end of the labium majus. They are due not to pressure, but to the general increase of vascularity in the pelvis and adjacent tissues. On separating the labia one may notice a slight violet discoloration of the mucous membrane, and some increase of moisture.

Cervix Very early in pregnancy the softening is distinct and appreciable to the finger. It is recognisable as early as the third or fourth week. This, of course, is also due to the increased vascularity, and for the same reason if the cervix were exposed through a speculum, a useful proceeding when the diagnosis of pregnancy is in doubt, some swelling, congestion and violet discoloration would be seen similar to that of the mucous membrane of the vulva. There is only one condition that on palpation simulates pregnancy softening of the cervix, namely, cervical "erosion." The velvety feeling of "erosion" is difficult to distinguish by the finger from the softening of pregnancy but on exposure by a speculum the catarrhal area is easily recognised.

not infrequently after even the most careful bimanual examination it may be impossible to say whether the uterus is enlarged or not. All that can be said is that its size is consistent with pregnancy.

Again the uterus may give the impression that it is more globular than normal. The non pregnant uterus is pear shaped although this again is to some extent altered by previous child bearing. In early pregnancy it seems to bulge antero posteriorly and also laterally and its surfaces seem to have become more



FIG. 1. Hegar's sign of early pregnancy. This sign is only present from the 6th to the 10th weeks. (Bumm.)

rounded. The consistence too is changed from being firm it has become softer and even acquired a slightly cystic feeling. All these signs may be very indefinite especially in the first four or six weeks. It is because of this indefiniteness that so much importance is attached to Hegar's sign now to be described.

Hegar's Sign. This sign can be elicited from about the beginning of the 6th till the end of the 10th week. It depends on the softening of the uterine isthmus from increased vascularity at a period when the ovum occupies only the upper part of the cavity. After the end of the 10th week the ovum occupies the whole cavity and the sign can no longer be obtained.

How to elicit Hegar's Sign (Fig. 1) The patient should be in the dorsal position with the knees drawn up, and the abdomen relaxed. One or two fingers are placed in the roof of the anterior fornix against the front of the uterus. The external hand is laid on the abdomen behind the uterus and the tips of the fingers are pressed gently downwards and forwards towards the tips of the internal fingers as if one were trying to make the fingers of the two hands meet. In pregnancy the fingers seem almost to meet so thin do the tissues between them appear to be. This is one of the most valuable of the signs of early pregnancy and is not found in any other condition.

Vaginal Moisture While carrying out the internal examination just described one may be conscious of an increased moistness of the vagina. Indeed there may be an actual discharge which may only be apparent when the finger is inserted into the pool in the posterior fornix and the posterior vaginal wall depressed so as to allow it to escape. The temperature of the vagina and the softness of its walls also seem to be appreciably increased.

The Later Signs of Pregnancy After the end of the third month these are usually quite definite and will not be described at length here. A uterine souffle may be heard as early as the middle of the 4th month. It may also be heard in large uterine fibroids but it is then unaccompanied by amenorrhœa, nipple pigmentation or softening of the cervix. Ballotement may be elicited at the same time or even earlier. It is most easily obtained by examining internally. On striking some part of the fœtus with the tip of the forefinger it floats away, then floats back and impinges on the finger again. Fœtal movements may be noticed by the patient as early as the 16th week but may be simulated by the peristaltic movements of the intestine. Fœtal heart sounds may be detected as early as the 18th or 20th week and are generally first heard in the mid line below the umbilicus. The height of the fundus at various stages of pregnancy is illustrated in Fig. 2.

X-rays in Diagnosis of Pregnancy Although a centre of ossification appears in the clavicle as early as the 7th week, X-rays are rarely successful in demonstrating the fœtal skeleton before the end of the 4th month. There are several reasons for this, chief among which are the thickness of the abdominal wall, the liquor amni surrounding the fœtus, the movements of the fœtus, and lastly the fact that in the early months the uterus is largely a

pelvic organ. Some observers nevertheless have claimed success as early as the third month. Since the introduction of the Zondek Aschheim test however the value of X rays in the diagnosis of early pregnancy has considerably diminished. Besides it is to say the least of it doubtful whether it is safe to expose the susceptible tissues of the *fœtus* to radiation at such an early stage of development especially if as may often happen more than one exposure is necessary.

The Zondek Aschheim Test. This test depends on the presence

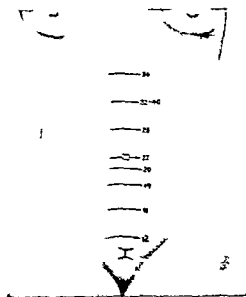


FIG. Height of fundus uteri at various weeks of pregnancy

in the urine of the pregnant woman of an anterior pituitary like substance which injected into immature mice produces a characteristic reaction with the formation of hæmorrhagic corpora lutea in the ovaries. The test is carried out as follows. Take five female mice three to four weeks old and weighing 6 to 8 gm. each. Inject them subcutaneously (usually in the buttock) twice daily for three days with slightly acidified morning urine. The urine need not be sterile. The quantities injected are as follows —

Mouse 1 = 0.2 c.c. at each injection

2 — 0.25 c.c.

Mouse 3 = 0.3 c.c. at each injection

„ 4 = 0.3 c.c. „ „

„ 5 = 0.4 c.c. „ „

The mice are killed at the end of 100 hours, and the ovaries inspected. The presence of one blood point¹ (easily visible to the naked eye and about the size of the head of a small pin) is sufficient for diagnosis. The test is correct in 98 to 100 per cent. of cases. It seems to depend on the presence of living chorionic epithelium, and may therefore be used as a test for death of the foetus in cases in which pregnancy is known to exist. As however, the chorionic epithelium survives for some time after death of the foetus the test does not become negative for eight to twelve days after foetal death has occurred, but if there has been gradual interference with the placental circulation prior to its complete cessation, such as occurs in placental infarction, it may become negative in three days.

As the Zondek Aschheim reaction becomes positive three to five days after the first period is missed, it can be obtained at a time when by no other means could the fact of pregnancy be established with certainty.

The Friedman Test This is a more rapid test for pregnancy than the Zondek Aschheim reaction, and gives results that are equally reliable. It is also an advantage that rabbits are used as they are more easily obtained than mice and are less likely to die as a result of the injections. The technique is as follows. A virgin rabbit is used which must not be less than twelve weeks old. Two intravenous injections are given (into an ear vein), each of 6 c.c. of morning urine not necessarily sterile daily for 2 days, that is, four injections in all, and forty eight hours after the first injection the animal is killed and the ovaries

¹ If the test is positive there are three reactions which may be observed in the ovaries, and they are known as reactions i, ii and iii. In reaction i the ovaries are slightly enlarged, pinkish in colour and often on naked eye examination enlarged follicles may be seen. On microscopic examination enlarged follicles with theca and cumulus oöphorus are seen. This reaction is not diagnostic of pregnancy but may be met with in myoma after castration, at the menopause, in carcinoma, especially of the genital organs and in endocrine disturbances, e.g., hyperthyroidism. In reactions ii, and iii the ovaries are enlarged and congested. Reaction ii is indicated by the presence of one or more blood points on the surface of the ovary and microscopically by massive bleeding into enlarged follicles. Reaction iii is indicated by the presence of corpora lutea. Reactions ii and iii are the only ones diagnostic of pregnancy. They can usually be recognised by simple naked eye inspection of the ovaries or with the aid of a hand lens. Very rarely microscopic examination is necessary.

inspected. Corpora hemorrhagica, which are easily seen with the naked eye projecting on the surface of the ovary, and much larger than the blood points seen in the mouse test, are indicative of



FIG 3 The Friedman Test. Negative result. Ovary of 12 weeks old rabbit, which had been injected with urine from a non pregnant woman ($\times 1\frac{1}{2}$)



FIG 4 Friedman Test. Positive result. Ovary of 12 weeks-old rabbit which had been injected with urine from a pregnant woman. Note projecting corpora hemorrhagica ($\times 1\frac{1}{2}$)

pregnancy (Figs 3 and 4). Kelly and Woods advise that the urine used in the test should not have a specific gravity of less than 1008, and that if it is necessary to use a urine of a specific gravity less than this, the quantity injected should be increased by 50 per cent.

It is important to be certain that ovulation has not taken place recently before the test is done (ovulation in the rabbit is dependent on copulation and takes place in eight to ten hours after it), and that the rabbit is not pregnant. Therefore the rabbits used should be isolated for at least thirty days. It is also recommended that each rabbit should be isolated to avoid the possibility of pseudo ovulation. In this condition the follicle develops to some extent, and haemorrhage occurs into it, but though the follicle is visible on the surface it is much smaller than in the positive test above described, and does not rupture.

The Hogben Test. The clawed toad (*Necopus levius*) has been recently used as the test animal. Its chief advantages are (a) that a result can be obtained in six to fifteen hours and (b) the toads are not killed during the test and can be used over and over again. (c) ovulation does not occur in absence of the male so that isolation is unnecessary. If the test is positive a shower of ova is ejected which can be easily seen with the naked eye. According to Crew whose paper should be consulted for details of the test there is 100 per cent agreement with the Zondek Aschheim and Friedman tests provided 2 c.c. of a 20 to 1 concentrate of urine is used.

Pregnandiol Excretion as a Test for Pregnancy. As in early pregnancy pregnandiol the excretion product of progesterone is present in the urine it may be used as a test for pregnancy when facilities for biological assays are not available. In the early weeks of pregnancy the amount excreted is small i.e. from 3 to 10 mg daily. If pregnandiol is absent (and its absence should be confirmed by repeated estimations), pregnancy may be excluded. A few cases however have been recorded of early pregnancy in which it was absent for a few days (Cope). The result of the test must therefore be considered in relation to clinical findings.

REFERENCES

- ASCHHEIM S. "Die Schwangerschaftsdiagnose aus dem Harn." Berlin, 1933.
 COPE C. F. *Lancet* 1949 ii 158.
 CREW J. A. L. *Brit. Med. Jour.* 1949 i 76.
 FRIEDMAN M. H. *Amer. J. Gynecol.* 1949 90 617.
 KELLY G. L. and WOODS L. B. *J. A. M. A.* 1949 103 615.

CHAPTER III

EXAMINATION OF THE PATIENT

THE examination of the patient should be conducted in an orderly manner. First the history is taken, then a general medical examination is carried out, and finally the obstetrical examination, which may or may not include an examination *per vaginam*.

The History

History taking follows the general lines laid down in the antenatal record form (Appendix A). The name and address of the patient, her age and parity, and the date of the last menstrual period are recorded, and the date of delivery estimated. Enquiries are made regarding the *family history* with special reference to any condition likely to affect child bearing such as tuberculosis, hypertensive cardiovascular disease or multiple pregnancies, the *personal history* with special reference to rickets, scarlet fever, rheumatism, sore throats, diphtheria, heart or kidney disease, cough, tuberculosis, appendicitis, operations etc., and the *history of the present pregnancy* especially any abnormalities such as sickness, oedema of the feet or face, headache, disturbances of sight, bleeding, constipation, breathlessness, sleeplessness, cramp, heartburn, pain, discharge (other than blood), varicose veins etc. Finally, the *history of past pregnancies and labours*, including the weights of the infants is obtained, and these should be set down in the order of their occurrence, and including abortions, for thereby important evidence may be obtained regarding the presence of syphilis, recurrent pregnancy toxæmia, or minor degrees of pelvic contraction. A suitable form for recording these particulars is that shown in Appendix A (see p. 578) which is that in use at University College Hospital.

General Medical Examination

After the history taking is completed the patient undresses, dons a dressing gown and slippers and passes a specimen of urine, her stature is measured and the weight taken, and she then lies down on the examination couch. The general medical examination is now carried out, going over the various systems and

organs in order (see Appendix A) The general state of nutrition is noted and the condition of teeth tongue and throat The heart and lungs are examined and while doing so opportunity is taken to observe the breasts and nipples The development of the breasts is noted and the condition of the nipples—whether everted or retracted The mucous membranes are examined for anemia, and should this be suspected it is well to have a blood count and hæmoglobin estimation carried out The feet and legs are examined to exclude œdema and varicose veins Oedema of the ankles may be due to pressure by the enlarged uterus or simply to prolonged standing but it may also be one of the earliest signs of pre eclamptic toxæmia and if it is present over the shins, or in the hands and face it is always abnormal If the œdema of the legs is due as it may sometimes be to congestive cardiac failure, it will be accompanied by breathlessness especially on exertion or lying down flat

A male distribution of hair, though rare, is worth noting for it may indicate a male type of pelvis (p 262) There may be evidence of rickets in the form of short stature, deformities of the long bones, rickety rosary of the ribs (beading of the costochondral junctions) or bossing of the forehead It should, however, be noted that such clinical evidences of rickets do not necessarily mean that the pelvis is contracted and on the other hand that the pelvis may be seriously deformed by rickets without much or any evidence of rickets elsewhere

Examination of the Urine

The ordinary investigation includes reaction, specific gravity, and an examination for sugar, albumin and pus If albumin is found a catheter specimen should be obtained in order to exclude the possibility that the albuminuria is due to contamination by vaginal discharge Only the result of the examination of the catheter specimen should be recorded The method of determining the significance of the albuminuria is discussed later (p 343)

Blood Pressure

This should be estimated at each visit in all patients whether pregnant for the first time or not, as a rise of blood pressure is often the earliest evidence of toxæmia Both systolic and

diastolic pressures should be taken and by the auditory method. The cuff should be carefully adjusted so that when inflated there is no bulging at its edges.

In University College Hospital the blood pressure is considered to be raised if the systolic pressure is above 130 and the diastolic above 70. Either the systolic or the diastolic pressure or both must be above this level and neither must be below it. No importance is attached to a rise of the diastolic pressure alone for experience has not shown it to be of any significance as a precursor of a rise of the systolic pressure. It is important to note that the blood pressure should be taken with the patient at rest preferably lying comfortably on a couch. If the systolic pressure is unduly high as compared with the diastolic i.e. if the difference is more than 60 mm the patient is probably nervous and especially if the systolic is above 130 it should be measured again after 5 or 10 minutes rest. It is even better to have the patient quietly at rest for 20 minutes and to estimate the pressure every 5 minutes during that time. This may make a difference of as much as 30 mm in the systolic pressure. The lowest reading should of course be recorded on the chart as the true level.

The above standard of 130/70 has often been criticised as being unduly severe. In support of our contention that it is not we would state that it has been in use in our department for many years and that increasing experience confirms its correctness. Further Robinson and Brucer in a recent study (1940) of the normal range of blood pressure came to the following important conclusions: (1) The normal range of blood pressure for men and women is 90 to 120 systolic and 60 to 80 diastolic. (2) Blood pressure in normal persons does not rise with age but it does rise in pre-hypertensive and hypertensive patients. (3) The daily and yearly variation of blood pressure in normal persons is 5 to 10 mm Hg. Higher levels of blood pressure show proportionately greater and more erratic yearly variations. (4) A blood pressure history is more nearly normal as it shows occasional pressures below 110 systolic and 70 diastolic. (5) A blood pressure history of over 120 systolic and 80 diastolic over a ten year period is pathological and is an almost infallible sign of incipient hypertension. (6) Transient rises in blood pressure should not be ignored and should lead one to suspect a further permanent rise. (7) Slightly over 40 per cent of the population is either actually or potentially hypertensive.

Weight-taking

The patient should be weighed at each visit, taking care, of course, that the clothing is of the same weight, or that allowance is made for any difference. There is evidence that abnormal increase may give early warning of the onset of pre eclamptic toxæmia (p 334)

The Wassermann Reaction

This is best carried out in every patient as a routine, for thereby a syphilitic patient is sometimes detected who would have been otherwise overlooked. If it is not done as a routine it should certainly be carried out if there is any history, obstetrical or otherwise, leading one to suspect the presence of syphilis. At least 10 c c of blood should be taken. The arm is held for a minute in the dependent position, the fingers closed and opened a few times, and a length of rubber tubing then tied around the arm well above the elbow, sufficiently tight to obstruct the venous but not the arterial circulation, and the pulse at the wrist should not be obliterated. The median basilic vein at the bend of the elbow is thus made to stand out and into it a large needle is pushed. The blood may be withdrawn into a syringe but this is unnecessary as enough drops quickly into a test tube held underneath.

Obstetrical Examination

After this general survey attention is directed to the abdomen, which is examined systematically. The patient should lie comfortably on her back with the head slightly raised so as to relax the abdominal muscles as much as possible and the bladder should have been recently emptied.

Before proceeding further it is well to estimate the exact duration of pregnancy in weeks. This is done by counting the number of weeks and days from the first day of the last period. Attention will thus be immediately drawn to any discrepancy between the duration of amenorrhœa and the height of the fundus

inch may be taken off this for each week less than term down to 34. An unduly large girth suggests multiple pregnancy or hydramnios but it may be due to fat or very rarely to a large ovarian cyst complicating the pregnancy or a large fibroid. In a recent case of ours it was due to foetal ascites.

Palpation is the next step. Always stand on the patient's right side facing her head. Make sure that the hands are warm. Suppose for purposes of description that the pregnancy is at term or near it. The height of the fundus should first of all be noted by placing the ulnar border of the left hand horizontally at its uppermost level.

Fundal Palpation Now lay both hands flat on the upper

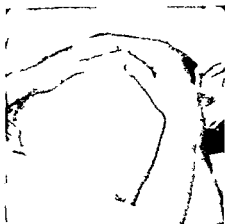


FIG. 5. Abdominal palpation. First step. Palpating the fundus.

part of the abdomen i.e. on the fundus (Fig. 5). Palpate gently and lightly not with the palms of the hands but with the pulps of the fingers which are more sensitive. At the fundus one should feel in a normal vertex presentation the somewhat soft indefinite and relatively immobile breech of the foetus.

Lateral Palpation Now bring both hands downwards still facing the patient's head along the lateral aspects of the abdomen so as to palpate the sides of the uterus (Fig. 6). If the position is a first or second vertex the back should be felt on one side and the limbs on the other. The back is recognised by its being flat. If in doubt it is a good plan to press the fundus gently downwards towards the pelvis (Fig. 7). This flexes the back and makes it more prominent. On the opposite side can be felt the foetal limbs.

They can usually be felt fairly distinctly, but in the primigravida with a thick abdominal wall they may be indefinite.

Method of palpating anterior shoulder (see p 132)

Pelvic Palpation Now turn and face the patient's feet Using

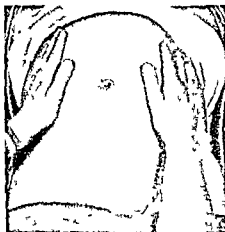


FIG 6 Abdominal palpation Second step Lateral palpation



FIG 7 Abdominal palpation Pressing the fundus downwards to make the back more prominent

the left hand and with the thumb on the mother's right side and the fingers on the left so that the ulnar border of the hand is uppermost, feel for the foetal head which will be felt either above the pelvic brim or fixed in the pelvis (Fig 8) If it is above the brim it can be easily recognised by its being harder and rounder than

the breech. If it is engaged in the pelvis it is more difficult to recognise, and if deeply engaged it may be impossible to feel it. In such cases it is useful to ask the patient to "let her breath out."



FIG. 8. Abdominal palpation. Third step. Pelvic palpation. Palpating the foetal head in a vertex presentation or the breech in a breech presentation. *A B*—The left hand is used and the examiner faces the patient's feet.



FIG. 9. Abdominal palpation. Fourth step. Pelvic palpation. Recognising the presenting part.

During expiration gently sink the fingers downwards and backwards behind the symphysis pubis. Just at the end of expiration the hard rounded head can be felt deep in the pelvis.

This is, we think, the most useful manoeuvre for palpating the head, but another is commonly practised and is indeed necessary

as by means of it we are enabled to decide whether the head is well or poorly flexed—not, by the way, a matter of great importance. In this both hands are laid on the abdomen, one on each side of the mid line just above the symphysis pubis, the tips of the fingers pointing downwards (Fig 9) and the thumbs almost touching each other. Firm pressure is made downwards and backwards over the pelvic brim so as to palpate both poles of the foetal head.

To detect whether the head is flexed or extended proceed as follows. Place both hands on the abdomen, one on either side

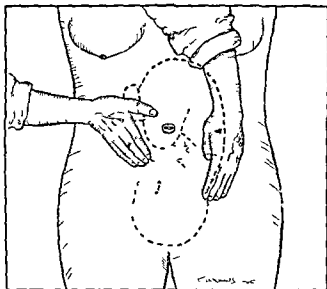


FIG 10 Abdominal palpation. Method of finding whether the head is flexed or extended. (Windeyer)

of the middle line with the finger tips about 2 inches below the umbilicus, so that they are well above the poles of the head (Fig 10). Now bring the finger tips gently downwards towards the symphysis till they come in contact with the head. If the fingers come first in contact with the sacrum, it is lying at a higher level than the occiput, and the head is therefore flexed. If the opposite is the case the head is extended, and if both poles are lying at the same level the head is midway between flexion and extension.

By these manœuvres therefore we determine —

(1) The presentation and position of the foetus

(2) In a vertex presentation whether the head is engaged in the pelvis

(3) Whether the head is flexed or extended.

A few important points regarding the engagement of the head may be noted here —

(1) In primigravidae the head should be engaged in the pelvis three weeks before term. It may of course be engaged long before this but if at or after this time it has not yet entered the pelvis we should try to find the reason. In the following conditions the head may not be fixed: (a) Contracted pelvis or disproportion in size between head and pelvis (b) Occipito-posterior position (c) Hydramnios (d) Multiple pregnancy (e) Placenta prævia (rare in primigravidae) (f) Pelvic tumours (g) A loaded pelvic colon or rectum (h) In fully 20 per cent. of cases no cause can be found and one can only explain it by assuming that there is lack of tone in the uterus or abdominal muscles. Ehrenfest suggests that some of them may be due to fixation of the cervix at an unusually high level in the pelvis. It should however be always borne in mind that the patient may be wrong in her dates and therefore not so far advanced in pregnancy as had been supposed. In such doubtful cases we may obtain helpful evidence regarding the stage of pregnancy from the date of quickening, the height of the fundus, but most of all from the size of the fetal head and by testing its hardness and the width of the sutures and fontanelles by vaginal palpation (for method see p. 279). It is important too to enquire carefully into the menstrual history. The periods may have been irregular before pregnancy began and the patient in the habit of missing one or two periods occasionally, in which case the amenorrhœa may have preceded the commencement of pregnancy by several weeks (p. 124).

Of all the causes of non engagement of the fetal head in the primigravida one of the commonest and the most important is disproportion and it cannot be too often or too strongly impressed upon the beginner that *when the head is found to be movable above the pelvic brim three weeks before the estimated date of delivery it is necessary to find out the reason and to exclude contracted pelvis*.

(2) In the multipara the head is often not engaged till the onset of labour or even until the beginning of the second stage. Its mobility in this case therefore need not necessarily cause any anxiety unless for some other reason disproportion is suspected.

Auscultation By auscultation we may detect a uterine or a funic souffle, as well as the foetal heart sounds

In listening for the foetal heart sounds it is important to note the point of maximum intensity. The binaural or Pinard's stethoscope may be used, but the author has for many years used only the direct method, with the ear applied to the abdomen, a thin towel intervening

Pelvic Measurements

The routine pelvic measurements taken are the interspinous, intercrisal, external conjugate, the diagonal conjugate and the size of the outlet. It is unnecessary to attempt to make accurate measurements of the outlet unless there is reason to suspect outlet contraction. Suspicion of this might be aroused, for example, if there were a male type of distribution of hair on the abdomen or elsewhere, as this is sometimes accompanied by a male type of pelvis with a narrow pubic arch.

Interspinous Diameter. This is taken between the *outer borders* of the anterior superior iliac spines. It usually measures from 9 to 10 inches (22.85–25.4 cm). If it is below 9 inches a generally contracted pelvis may be suspected.

Intercristal Diameter. This is measured between the *farthest apart points of the outer borders of the iliac crests* and should measure 10 to 11 inches (25.4–28 cm). It should be at least $\frac{1}{2}$ inch (2 cm) greater than the interspinous diameter. Less than this may indicate contracted pelvis of the flat type, while a measurement below 10 inches (25.4 cm), yet exceeding the interspinous diameter by the normal amount, may indicate a generally contracted pelvis.

External Conjugate (Baudelocque's Diameter). This is measured from the anterior surface of the symphysis pubis just below its upper border, to the depression below the tip of the last lumbar spine. In order to measure it the patient should lie on her left side, with the knees moderately flexed. To find the tip of the spine of the last lumbar vertebra drop a perpendicular to the couch through the highest point of the uppermost iliac crest and mark where this line cuts the mid line of the back. The desired point is $\frac{1}{2}$ inch (1.3 cm) below this. An alternative method is to take a point $1\frac{1}{2}$ inches (3.8 cm) above the centre of a line joining the two posterior superior iliac spines. The external conjugate should not measure less than $7\frac{1}{2}$ inches (19 cm). Though it is not always an

easy measurement to take especially in a fat woman it is in our experience a most valuable one and if definitely less than $7\frac{1}{2}$ inches (19 cm) always means a contracted pelvis. The fact however that the external conjugate measures $7\frac{1}{2}$ inches (19 cm) or more does not exclude pelvic contraction and this limitation of its usefulness should be borne in mind.

The Diagonal Conjugate This is the distance between the lower margin of the symphysis pubis and the centre of the sacral promontory and is by far the most important pelvic measurement.



FIG. 11. Measuring the Diagonal Conjugate. The left hand is internal in this figure but it is more usual to use the right.

It is not necessary nor indeed possible to measure it in every case for if the head is in the pelvic cavity the promontory cannot be reached without pushing the head above the pelvic brim. This would be unjustifiable interference as with the head in the pelvic cavity there cannot be any disproportion between head and pelvic inlet which matters far more than the diagnosis of a slight degree of pelvic contraction.

When should the diagonal conjugate be measured? It may, of course be done at the first visit however early in pregnancy that may be but it is better to put it off till the 30th week or even later for the vulval ring and especially the perineal body are then softened and offer less resistance to the upward pressure of

the examining hand. The promontory can therefore be reached with greater ease and with less distress to the patient than if the examination had been carried out in the early months.

Measuring the Diagonal Conjugate The following is the best method of measuring this diameter. The patient should lie in the left lateral position with the thighs well drawn up and the knees bent. Sterile gloves are worn and the external genitals are rendered surgically clean. The labia are gently separated by the fingers of the left hand, and the index finger, or the index and middle fingers, of the right hand are introduced into the vagina and passed upwards until the promontory is reached (Fig. 11). In order to reach the promontory it is always necessary to press the vulva and especially the perineal body upwards and backwards, and at the 30th week or later this can be done to a considerable extent, and without causing much distress to the patient. How is the promontory recognised? Just above the promontory the bone recedes from the finger. The finger should therefore be pushed upwards on the front of the sacrum until the bone is felt to recede. Immediately below this point is the promontory. This is an important precaution to take as unless it is observed the finger may be simply resting on the front of the sacrum far below the promontory, and an altogether false idea of the length of the diagonal conjugate may be obtained.

The point where the examining hand impinges on the under surface of the symphysis is marked with the tip of the index finger of the left hand. The hand is then withdrawn and the distance between the point marked and the tip of the finger that reached the promontory measured. This is the diagonal conjugate, and normally measures 5 inches (12.7 cm). By subtracting $\frac{1}{2}$ inch we get the length of the true conjugate which should therefore measure $4\frac{1}{2}$ inches (11.5 cm).¹

When the diagonal conjugate is of normal length it may be impossible to reach the sacral promontory. If however the promontory cannot be reached at $4\frac{3}{4}$ inches it can be assumed that the true conjugate is normal.

Before withdrawing the hand an attempt should be made to obtain some idea of the general shape and capacity of the pelvis.

¹ Ince and Young, in their radiological investigation of 500 female pelvises in University College Hospital, London found that the mean length of the obstetrical true conjugate diameter was 118 millimetres ($4\frac{3}{4}$ inches) and of the anatomical true conjugate 122 millimetres ($4\frac{1}{2}$ inches). It appears therefore that we must regard a true conjugate of less than $4\frac{1}{2}$ inches as abnormal.

The method of doing this and the points to be noted are described at p 263

Measurement of the Outlet. This should be carried out as a



FIG 12 Measuring the antero-posterior diameter of the outlet
Finding the tip of the sacrum (Chassar Moir)



FIG 13 Measuring the antero-posterior diameter of the outlet,
second step (Chassar Moir)

routine procedure at antenatal examination With the patient in the left lateral position the length of the transverse diameter may be gauged roughly by pressing the knuckles of the four

fingers between the ischial tuberosities. A more exact method has been recently described by Chassar Moir (Fig 14). The transverse diameter should measure $4\frac{1}{2}$ inches (10.5 cm).

For measuring the antero posterior diameter ($5\frac{1}{2}$ inches 13.0 cm) he advises the following procedure (Figs 12 and 13). The exact position of the tip of the sacrum is first determined and on this point the tip of the middle finger is pressed. The hand is then raised until the under surface of the pubes impinges on the base



FIG 14 Measuring the transverse diameter of the outlet (Chassar Moir)

of the finger or knuckle. From this the measurement can later be obtained. An empty rectum is essential for the test.

The antero posterior diameter may also be measured by an ordinary pelvimeter. The end of one blade is placed on the lower margin of the symphysis and the end of the other on the external surface of the tip of the sacrum. One centimetre must be deducted for the thickness of the sacrum.

It is of course possible to measure the outlet very accurately by means of X rays—the antero posterior diameter on the lateral view of the pelvis and the transverse diameter on the antero posterior view (*vide infra*).

X Ray Pelvimetry In certain clinics an X ray examination of the pelvis is now a routine measure in all primigravidae. It should certainly be carried out in every case in which there is any reason such as short stature, evidence of rickets, or of male type

of pelvis, high head within three weeks of term in a primigravida or a history of difficult delivery. Two views should be taken—an antero posterior, looking down into the pelvis, and a lateral view. The methods in common use are described in Chapter XXXV. By using both views accurate measurements can be made of the important diameters as follows.

(1) *At the Inlet* (a) The true conjugate extending from a point on the posterior surface of the symphysis pubis 1 cm. below its upper border to the mid point of the promontory of the sacrum ($4\frac{1}{2}$ inches 11.5 cm.), (b) the transverse diameter, *i.e.*, the longest distance separating the ilio pectineal lines (5 inches, 12.5 cm.) (c) the posterior sagittal diameter, *i.e.*, the part of the true conjugate lying posterior to the transverse (2 inches, 5 cm.)

(2) *At the Outlet* The plane of the outlet (plane of least pelvic diameters) extends from the lower border of the symphysis pubis backwards at the level of the ischial spines to a posterior point about the junction of the sacrum and coccyx. On this plane the following diameters can be measured (a) the antero-posterior ($5\frac{1}{2}$ inches 13.0 cm., Nicholson), (b) the interspinous between the tips of the ischial spines ($4\frac{1}{4}$ inches 10.5 cm., Nicholson), (c) the transverse, between the two farthest apart points on the inner surfaces of the ischial tuberosities, usually about 1 inch in front of the base of the ischial spines ($4\frac{1}{4}$ inches, 10.9 cm., Ince and Young) (d) the distance between the sacrum and the line joining the ischial spines (*i.e.*, the width of the sacro-sciatic notch), (e) the posterior sagittal diameter—the part of the antero posterior diameter behind the transverse ($3\frac{1}{2}$ inches 8.5 cm.)

In addition to the measurements above described, occasion should be taken to observe the general shape of the pelvic inlet, including its forepart (p. 263) the shape of the sacro-sciatic notch the length and curvature of the sacrum the depth and inclination of the symphysis, and the width of the subpubic angle. In Ince and Young's series of 466 pelves this angle ranges in order from 76° to 120° with a mean of 93.5° . If the pictures are taken at term the size of the foetal head can be measured at the same time in the lateral view and its relation to the pelvic brim studied. The methods used in doing this are described on p. 546.

Internal Examination

At the time of measuring the diagonal conjugate the pelvis may be explored for the presence of a tumour, cyst, or other abnor-

malty, if this has not been done previously. In the above description of the examination of the patient we have assumed that the pregnancy is at term or near it. Nowadays, however, most patients come to the clinic at an early stage of pregnancy. It is always advisable to *make a vaginal examination at this first visit*, in addition to the general examination, for thereby some abnormality such as an ovarian cyst in the pouch of Douglas, giving rise to no symptoms may be discovered. An opportunity is thus afforded to treat it at a time when treatment is easy and safe, and before it causes complications. At the same time the opportunity should be taken to look for abnormal vaginal discharge. As previously explained (p 38), it is better to postpone attempts to measure the diagonal conjugate till the 30th week or later.

Vaginal Discharge

Every woman has a vaginal discharge in pregnancy, especially after the third month. It resembles condensed milk in colour and consistency, is not seen on merely separating the labia but only on inserting the forefinger into the posterior fornix and depressing the posterior vaginal wall so as to allow the discharge to escape. If the discharge is so profuse as to be evident on separating the labia and especially if the vulva is red and inflamed or there is pruritus it is probably abnormal and should be investigated at the first visit so that treatment may be started at once. The method of investigation is described on p 531.

Reassurance and Advice

This completes the routine examination of a normal patient. The examination should at all stages be carried out with the utmost gentleness, and *every effort should be made to reassure the patient and to gain her confidence and co operation* (p 47). Arrangements for confinement will be discussed, advice will be given regarding the hygiene of pregnancy, including diet, care of the breasts and nipples, bowels etc. It is usually an advantage to put into her hands one of the excellent booklets¹ giving advice on the care of the health during pregnancy. Such a book can be studied at leisure, and the physician can mark paragraphs to which special attention should be given. In this way he is more likely to obtain

¹ A suitable one which also contains a chapter on 'Preparations for Confinement' is the Author's 'Advice to the Expectant Mother on the Care of her Health and that of her Child'. Fifth Edition. Livingstone Edinburgh. Price Sixpence.

the co operation of his patient in carrying out recommendations for advice to a nervous woman however painstakingly it may be given is liable to be all too soon forgotten. As an alternative a leaflet may be given containing a few simply worded instructions (Appendix E)

Frequency of Examinations

The patient should be seen every month from the time of booking until the 30th week, every fortnight from then till the 36th week and thereafter every week until delivery. This is the least that can be regarded as adequate. A definite date should be given for the next visit and a note of this should be kept. Failure to keep an appointment should always lead to enquiry into the reason. This may be in the first instance by letter but if this fails a personal visit should be paid. Very rarely indeed is it necessary to decline further responsibility because of non attendance. In clinics these records are usually kept by the sister in-charge and she through her staff, or through the social service department should keep closely in touch with patients to ensure regular attendance, and to see that as far as possible advice given at the clinic is followed.

Subsequent Examinations

In normal cases obstetrical examinations should take place at the 30th and 36th week and for the last time a week or so before the expected date of delivery. These will include the ascertainment of the presentation and position, the situation of the head in relation to the pelvic brim and the auscultation of the foetal heart and of course there will be in addition the routine examination of the urine, blood pressure etc. At the visit at the 30th week it is necessary to exclude breech presentation for if it is found it will soon be necessary to perform external version (p 188). At the other visits it is usually sufficient to interview the patient. The urine is examined, blood pressure is estimated, oedema is watched for, the weight is taken, enquiry made regarding the general health and necessary advice given. A date should always be given for the next return visit and a note of this date should be made.

Visit to the Patient's Home

If the confinement is to take place in the patient's own home it will be well for a nurse to visit the house at least once about two months before the expected date in order to see the arrangements

made for the delivery. Attention will be paid to such matters as the selection and preparation of the lying-in room, arrangement of the bed, etc. Instructions with regard to materials to be obtained for the confinement, such as rubber sheeting, cotton wool, disinfectants, sterilised dressings, etc., will already have been given in the clinic, and it will now usually be only necessary to look over them to see that all is in order.

Co-operation of the Patient

As previously pointed out, every effort should be made throughout the examination above outlined to reassure the patient and gain her confidence and co-operation, which are in the highest degree essential to success. In this connection I cannot do better than quote Dr. J. S. Fairbairn, who has probably done more than anyone else to emphasise the importance of this rather neglected aspect of antenatal care: "Time given to talks and discussions about the many trifles that occupy her mind is never in vain, and the care and thoroughness with which her case is investigated arouse in her the confidence in her attendants and in herself that is a necessary prelude to successful supervision . . . The presentation to the woman's mind of childbirth as a natural process must be a guiding principle throughout all talks and examinations. Most women have a proper perspective, but a material proportion approach pregnancy and labour with a view distorted by what they have heard or read of the terrors of labour, of its long duration and its dangers. Some may have had a previous unfortunate experience which has left a marked impression, or the pregnancy may be unwelcome, possibly even deeply resented, and its termination unsuccessfully attempted, with an added fear that danger in labour is thereby increased or that the foetus may be malformed. A not uncommon type requiring special management is that of the woman who looks on child-bearing as a burden and is unwilling to make any sacrifice she can avoid. These are examples of difficult cases requiring careful consideration from the psychological side, but all will benefit by confidential talks in which the woman can show what is in her mind, and possibly reveal hidden dreads that otherwise she would keep to herself, thus possibly interfering in some way with normal function."

The following section, still further elaborating these ideas, has been kindly written by Mr. A. J. Wrigley.

The Prenatal Preparation for the Confinement

In this section an attempt will be made to indicate the lines on which the confidence of the woman in herself and in her doctor is likely to be increased and some possible means whereby the factor of fear may be lessened by short explanations of the nature of childbirth and of the ways in which the patient can help herself and her attendants

The initial visit of a woman pregnant for the first time to the medical man or woman who is to be asked to take charge of the confinement will probably be an ordeal for the patient, especially if the patient and doctor are strangers and have not met before. Not that she is entirely ignorant of prenatal supervision as this branch of medicine is now widely recognised by the public. The woman however will have only an uncertain idea as to the nature of the investigations necessary and if she is apprehensive she will always anticipate the worst. As a result an enormous amount of good or harm may result from this first interview and it is proposed to put down a few principles the acceptance of which it is believed will make the way easier for both the patient and her doctor

At this the first visit there are several items of a domestic social and economic nature to be discussed and with the exception of a few enquiries as to the general health of the patient an excuse can easily be made if it is thought to be desirable to do so to postpone any medical examination. Thus it is of practical importance before agreeing to be responsible for a confinement in the home to ascertain something of the nature of the house and the room in which the event shall take place. Such matters as the presence, nature and proximity of the water supply and the lavatory must be noted. These are the days of divan beds and it is most unwise to attempt the delivery of a baby on a bed of this design. When a woman is confined in childbirth she can no longer look after her own home, and in consequence it is necessary that help of an irreproachable reliability be obtained. If any of such items are unsatisfactorily provided for or if the financial resources are likely to be severely strained by a confinement at home it may be a wiser plan to suggest or insist that the patient goes to hospital.

One of the greatest benefits of regular antenatal supervision is that patient and doctor have a chance to know and to understand each other. The bearing and attitude of mind of a doctor toward

a woman is of greater importance in pregnancy than probably at any other time. Such characteristics as indecision, roughness in examination, or possibly slackness by not insisting on regular visits are watched for by the majority of women. It is almost as if the patient consciously or unconsciously is judging the skill with which her confinement is to be managed by the behaviour of her doctor in the prenatal period and of course she is generally perfectly correct in this assumption. As this confidence is going to be a factor of enormous importance in the diminution of fear, the conclusion is obvious.

The Value of Explanation and Reassurance

At the first examination of the patient it is a wise plan to explain to the patient the nature of each investigation and the possible value of the information obtained. The woman should be told when each and every examination reveals a normal and natural state of affairs. The routine examination of such a patient with perhaps a brief remark at the end to the effect that all seems to be normal is not likely to carry the same reassurance as a detailed account of the findings. In addition an explanation of what is being done will be more likely to ensure the co-operation of the woman, and will facilitate in consequence the vaginal examination. No question asked by the patient however stupid it may appear, should ever be turned down lightly. It is probable that the doubt has been a source of worry for some time and a full explanation must be given as to why her fears were needless and why she need have no worry over that particular point. Thus a woman will frequently ask if the baby is in the correct position in the early months of pregnancy or will have been told by friends that she is too small to have a natural birth. An imperfect or careless answer will mean untold trouble in the next few months.

If any abnormality is discovered a decision must first be made as to whether the patient need be told at all and if told it is a far wiser plan to tell everything. To leave the patient with the impression that something is being kept from her will at once produce the feelings of fear and anxiety, whereas the knowledge that an abnormality has been discovered and its possible importance assessed will add to the confidence she has in her doctor.

By proceeding upon these lines and by the use of common

sense the patient should reach the end of pregnancy with a sense of confidence in her doctor that will do much to lessen her fear of the labour

Another source of anxiety lies in the fact that she has never before experienced the pains of childbirth. Her information upon the nature of the forthcoming ordeal will be acquired from conversation with relatives and friends, or from books and periodicals, or in these days even from the cinema and theatre. It is a curious paradox that the majority of so called friends appear to take considerable care to impress upon the primigravida accounts of every abnormality and complication of childbirth that they themselves have experienced, or which have been related of others. These accounts are remembered and the many others who may state that the experience was far less of an ordeal than was expected are apt to be put on one side as being the exceptional and lucky. Many modern novels are considered incomplete without a lurid, alarming and detailed description of childbirth, the reading of which will do any thing but reassure a prospective mother.

Women's journals frequently contain articles on childbirth of a semi medical nature, and, however good the intentions therein, the impression left is that the reader is about to embark on a most exhausting experience, but she must make the best of it. The duty of the doctor is to ascertain what ideas the patient already has and to ask her if she has gleaned any information from any source as to what she is likely to experience. The most surprising replies will be forthcoming, and again an explanation of what is probably a more normal state of affairs as it exists in reality should go far to help. Not that the pain and discomfort can, or should, be belittled in any way, but rather that fears that have no foundation must be dispelled. It is believed that this aspect of antenatal work is of great importance and that it has received hitherto little or no attention.

Explanation regarding the Nature of Labour

Another worry to a large number of women is that they are naturally entirely ignorant of the nature of a labour, and in consequence as to what is expected of them. During the last two or three visits of the patient it is advised that the medical attendant spends a few minutes in explanation. First give a brief description of the usual ways in which the onset of labour is to be recognised

In the majority of patients this occurs with the onset of the labour pains. The patient is told that she recognises these pains by the fact that they occur at regular intervals, that they must coincide with a hardening of the abdomen, and that they are felt in the lower abdomen and back. Those women who have suffered from spasmodic dysmenorrhœa should be told that the first pains of labour are similar to the pains they have experienced at their periods and that frequently they are not so severe. Less often a "show" of mucus or blood precedes the onset of the pains and it may be wise to explain why the show occurs. Occasionally rupture of the membranes takes place. This is always an alarming event. The woman should be told that in all probability its significance is trivial, that it usually occurs at night, that she should inform her doctor at once and remain quiet until she has been examined.

A brief explanation of what is taking place in the first stage of labour should be given and it is considered to be most important to impress on the patient that although she will experience no sense of progress during this stage, nevertheless such progress will be taking place automatically. She should be told that until and unless the pains occur with great rapidity she will be better up and about, that she should have meals, and that the more she can occupy her mind in the intervals the better. Ordinary clothes are not worn because they may not be clean or because they may become soiled. If the pains are very strong and occur at short intervals, she will be likely to gain confidence when she has the knowledge that the length of the labour will probably be correspondingly shortened.

Some explanation of the effects and the factors that govern the administration of hypnotic and analgesic drugs should be given. Every woman could in theory be given a painless labour, but there would be very few live babies. Explain that whereas it is not advisable to give pain relieving drugs at the beginning of labour owing to their effects in inhibiting contractions and their action on the baby, it is equally harmful to delay their administration until a stage of real exhaustion is reached. The majority of women rapidly appreciate the situation, and with an improved understanding their co-operation often is greatly increased. Similarly, an explanation as to why it is impossible to consider general anæsthesia at an early stage is far more likely to be accepted than no explanation at all.

REFERENCES

- EHRENFEST H *Am Jour Obst & Gyn* 1936 32, 750
 FAIRBAIRN J S *Practitioner* 1932 129 313
 INCE J G HASTINGS and YOUNG MATTHEW *Jour Obst & Gyn Brit Emp.*,
 1940 47, 130
 NICHOLSON C *Lancet* 1936 ii 615
 ROBINSON S C and BRUCE R M *Archives of Internal Medicine* 1939 64 409
 ROBINSON S C and BRUCE R M *Archives of Internal Medicine* 1940 66 39*

CHAPTER IV

THE HYGIENE OF PREGNANCY

WHILST it is a truism to say that pregnancy is a physiological function, and while many a woman derives benefit from some harmonious relationship between herself and the foetus, yet every obstetrician knows that pregnancy is also a period of stress and strain, and that few women pass through it without more or less functional, or even organic, disturbance. By judicious and timely advice regarding details of personal hygiene, the medical attendant can do much to obviate such disturbances, and to prevent them from developing and constituting a serious menace to health. Besides, pregnant women, especially of the better class, are accustomed nowadays to take an intelligent interest in their own welfare, particularly in matters of diet, on which they are kept well informed by the lay press. The worker in the antenatal clinic has, too, a peculiarly favourable opportunity for educating a section of the population who stand badly in need of such instruction, in matters of personal cleanliness and general hygiene. Most patients come to their medical attendant only during illness, when the chief concern is to get them well, and personal hygiene is of secondary importance for the time being. The expectant mother, on the other hand, is usually well and therefore able to carry out the measures advised. She is in a receptive frame of mind and therefore willing to do so, and we can use the additional argument that the health measures we advocate are for the benefit of her child, as well as of the mother herself. A woman who has hitherto paid but little attention to the common rules of healthy living may, during pregnancy, with a little judicious guidance, form habits of sleeping with open windows, of regular bathing, care of the teeth and so on, which to her great benefit may become part of her daily routine throughout the rest of her life. In our, quite proper, eager hunt for abnormalities in the pregnant woman, thus positive and constructive, and in the literal sense of the word, preventive aspect of antenatal care is apt to be neglected and relegated to a position both in time and place that does little justice to its importance.

The object of antenatal care therefore should not be so much to discover or even to diminish the incidence of abnormality in

pregnancy and parturition, as to secure normality and a high standard of mental and bodily fitness. Only by making this our aim can full advantage be taken of the great opportunities afforded by the clinic in so far as constructive physiology is concerned, and perhaps only then shall we realise our essential ignorance concerning the physiology of pregnancy and take adequate steps to remedy it.

These constructive efforts are especially liable to be neglected in the crowded antenatal clinic where the medical officer is obliged to see large numbers of patients in a limited time, and in that respect the clinic compares unfavourably with good-class private practice. On the other hand it affords an unparalleled opportunity for group instruction if a little trouble is taken to organise it. Instruction in the form of talks or demonstrations can be given by the medical officer especially if a woman by a sister or social worker or even by a voluntary helper, provided she has the necessary equipment, particularly in respect to knowledge of elementary physiology and hygiene to make the talks interesting and helpful. Such talks each of which should be limited to half an hour may be given during clinic hours or immediately before or after as seems most convenient, and suitable subjects will readily suggest themselves, such as 'How the child lives and grows before birth,' "General care of the health in pregnancy," "Food in pregnancy including its influence on the health of the child." "Baby's first month," "Breast feeding," "Baby clothing." "Preparations for confinement, etc. etc."

Group instruction can however, never entirely replace personal talks as each woman has her own individual problems of health, hygiene and domestic circumstances. These personal talks are time consuming and necessitate the employment of a staff sufficiently large to meet all demands, without being or even seeming hurried for the more of the leisurely tea table atmosphere that can be introduced the better. If practical classes in mothercraft can be added the value of the teaching will be much increased.

The possibilities from treatment of all expectant mothers by artificial sunlight has been recently impressed upon me by a visit to the antenatal clinics of the Durham County Council where

¹ An excellent series of addresses to mothers with 'Notes for speakers' has recently appeared in 'Mother and Child'. Titles and other information regarding them can be got from the Business Manager of "Mother and Child" 5 Tavistock Square London W.C.1

its use is routine. The Maternity and Child Welfare Medical Officer, Dr Edith S Williamson, is convinced of its value in improving the patient's general health, and in relieving sleeplessness and other minor disabilities. The mercury vapour lamps used in their clinics are supplied by Hanovia Ltd, Slough England.

Further directions in which these efforts at constructive physiology may extend, especially as regards the psychological aspects of pregnancy and labour, will be discussed in the two succeeding chapters.

Diet in Pregnancy

There is no reason to suppose that any appreciable increase in the quantity of food is necessary in pregnancy for though the basal metabolic rate is raised after the 4th month (p 455) it is probable that the rise is neutralised by the reduction in muscular activity. The League of Nations Technical Commission takes 2,800 calories as the daily requirement of an adult female whether pregnant or not. Some clinicians indeed advocate a restricted caloric intake in pregnancy on the ground that it prevents the foetus from getting unduly large and Prochownik, of Hamburg in 1889 recommended a diet containing a reduced allowance of carbohydrate and fluid in the last six weeks, so as to minimise the deposit of fat in the subcutaneous tissues, including those of the scalp, and thus reduce the size and weight of the foetus at birth. The bones of the cranial vault were believed to be softer and hence more easily moulded. But there is no real evidence that the diet of the mother has any influence on the child's weight, or that there is any correlation between the weight of the child and gain in weight by the mother, though there is reason to believe that a generous diet in pregnancy increases the probability of successful lactation (Garry and Striven).

It would appear, however that although no addition to the total caloric intake is necessary in pregnancy, an increase in the proportion of protein is advisable. The League of Nations Commission takes as the minimum protein requirement of an adult 1 gm per kilo of body weight, but for pregnant and nursing women 2 gm per kilo are advised (about 100 gm daily). The increase in protein requirement is chiefly due to the fact that the pregnant woman has to provide for the needs of the growing foetus and for the growth of the uterus. During pregnancy there is a retention

of about 145 gm of nitrogen, made up as follows—fœtus 70 gm, placenta, liquor amni and membranes 19 gm, growth of the uterus and breasts, 39 gm and 17 gm respectively. This represents six times that figure in protein or about 1000 gm. At least half this protein should be “first class” i.e., derived from animal sources—milk, eggs and meat, the protein of which has a higher biological value in that it contains certain essential amino acids such as tyrosine, tryptophane and cystine, which the body cannot itself synthesise. There is no evidence that a high protein intake is harmful though it is possible that it makes necessary an increased consumption of vitamins B and D (Theobald). It may therefore be said that, provided the diet is already a generous one no modification of its quantity is necessary in pregnancy.

Much more important, however, than the quantity of the energy-giving constituents protein, carbohydrate and fat is it to ensure that the diet contains a proper provision of mineral salts chiefly calcium phosphorus and iron and of the protective accessory food substances or vitamins. Necessary as all these are in the diet of the ordinary adult they are much more so in that of the expectant mother, who has to provide not only for her own needs but also for the needs of the rapidly growing and developing organism within her. In the next section we shall consider in detail what the requirements of these substances are, and the consequences that may follow deficiency of each of them.

Mineral Requirements

Calcium and Phosphorus In pregnancy there is a great demand for lime salts and phosphorus for building the fœtal skeleton. The fœtus at term contains about 30 gm of calcium and 18 gm of phosphorus and this is chiefly laid down in the last three months (Table III).

Unless there is an adequate supply of calcium and phosphorus in the food the amount necessary will, as far as possible, be obtained from the mother's stores in the skeleton. Even the supplementary minerals thus obtained may be insufficient, and in consequence defective calcification may occur in the fœtus which predisposes to rickets in infancy and childhood. Toverud and Toverud estimate that from 1.6 to 1.7 gm of calcium and from 1.8 to 2 gm of phosphorus daily must be

TABLE III *Showing Daily Fetal Retention of Calcium, Phosphorus and Magnesium (Michel)*

Age of foetus	Ca (Gm)	P (Gm)	Mg (Gm)
Up to 4th month	0 015	0 010	0 001
4th to 5th ,	0 021	0 013	0 001
5th to 6th ,,	0 051	0 026	0 002
6th to 7th ,	0 060	0 036	0 002
7th to birth	0 456	0 254	0 010

ingested to ensure sufficient retention to meet the needs of the foetus and prevent a negative balance of these substances in the mother. This minimum is, however, rarely attained. Thus these workers found that in 100 pregnant women in Oslo, Norway, the calcium intake rarely exceeded 1 gm daily, and was usually not over 0.6 to 0.7 gm, while Coons and Blunt (U.S.A.) found that in eight out of nine pregnant women the calcium intake was under 1 gm daily. In neither case therefore was the daily intake sufficient to meet the needs. It is probable that in Great Britain, where milk consumption is low, the state of matters is not more satisfactory. Orr (Food, Health and Income, 1936) estimated the average calcium intake among the pregnant poor in England as 0.37 gm daily.

Milk is the richest source of calcium, and about 70 to 80 per cent of the calcium in the diet is derived from it. One litre of milk contains 1.2 gm of calcium and therefore about 1 quart daily, giving 1.4 gm, is necessary with other calcium containing foods, to ensure a sufficient intake. Besides, the calcium and phosphorus in milk are in the most suitable form to ensure retention. Other less important sources of calcium are oatmeal, fruits, vegetables and green leaves. It can, of course, also be supplied in the form of soluble salts, such as calcium lactate or gluconate, but it is better to give it in its natural form, as in the above named foods, which contain other valuable food factors in addition.

Foods rich in phosphorus are milk, cheese, egg yolk, lean meat

liver whole wheat oatmeal beans spinach brussels sprouts and potatoes

Effect of Calcium and Phosphorus Deficiency on the Offspring
There is conclusive experimental and clinical evidence to show that a calcium and phosphorus deficiency in the diet of the pregnant woman or a deficiency of either predisposes the child to rickets. In cases of extreme deficiency rickets may even be present at birth (Preston Maxwell Toverud and Toverud). It is more common however to find that the child is born with a *predisposition* to rickets—a predisposition which is not always capable of being overcome by good postnatal feeding. Korenchevsky and Carr have shown that in rats rickets changes could be induced more rapidly and with greater certainty in the offspring if the mother during pregnancy had been fed on a diet deficient in anti-rachitic vitamin (vitamin D) and calcium. Mellanby found that if bitches are fed during pregnancy on a diet that in the case of puppies will lead to rickets then the offspring have a greater tendency to develop this disease and this tendency in the young is not removed by a period of good diet but may become evident again at a later period of defective feeding.

Hypoplasia and defective calcification of the enamel and dentine of the teeth is another consequence. The calcification of the deciduous teeth takes place from the 17th week till the end of pregnancy and that of the permanent teeth takes place partly in the latter part of pregnancy partly during lactation and partly in childhood. If calcification is defective the resistance to caries is much diminished. Toverud and Toverud found that the children of mothers who had taken less than $\frac{1}{2}$ litre of milk daily during pregnancy showed twice as much caries as the children of mothers who during pregnancy had had a high milk vegetable and fruit diet. They assert too that while a predisposition to rickets may be overcome by good postnatal feeding hypoplasia of the enamel and dentine cannot be so remedied.

Breast milk may be deficient in calcium and hence well marked rickets may develop even in breast fed infants. It has been shown for instance that the calcium content of mothers' milk may vary from 18 to 31 mg per cent on an ordinary home diet but on a diet rich in calcium it may increase to as much as 42 mg per cent.

Effect of Calcium and Phosphorus Deficiency on the Mother
Less is known in regard to this. If there is very marked and

prolonged deficiency, especially if it is continued throughout several rapidly succeeding pregnancies, osteomalacia (adult rickets) may develop. This disease, which is common in parts of India and in Northern China, is accompanied by softening of the bones, and often by extreme pelvic deformity. It attacks both sexes, but pregnant women are specially prone to it, and in them it often progresses rapidly. It has been shown by Preston Maxwell, Green Armytage and others to be due to deficiency of the diet in calcium, phosphorus and vitamin D, aggravated by lack of sunshine. Preston Maxwell has proved, too, that the foetus in such cases may suffer from rickets and defective formation of the teeth. Thus is provided clinical confirmation of the experimental work of Mellanby and others. The condition can be prevented or arrested by the administration of calcium (or milk which contains it) and cod liver oil. Though fully developed osteomalacia is rare in Great Britain, it is probable that minor manifestations of its earlier stages, such as restlessness, sleeplessness, muscular twitchings, pains in the pelvis, back and thighs, and violent movements of the foetus, are not infrequent.

It was till recently believed that a common result in the mother of a diet deficient in calcium during pregnancy was dental caries because of the decalcification of the dentine and enamel to supply the needs of the foetus. Hence the saying "for every child a tooth". It is probable, however, that unlike the skeleton the teeth are not calcium depôts, for in hyperparathyroidism, while gross depletion of the calcium in the skeleton occurs, the teeth remain normal. Ziskin and Hotelling studied the teeth of 324 pregnant women and compared the progress of caries with that in non-pregnant controls. They concluded after a careful statistical analysis of the data, that pregnancy is not a cause of dental caries and indeed that some factors operating during pregnancy actually prevent decay.

Various other disturbances of pregnancy have been attributed to calcium deficiency by Vignes and others, such as cramps, tetany, vomiting of pregnancy (from tetanoid contraction of the pylorus), and even eclampsia (p. 313), and in labour uterine inertia (from lack of muscle tonus) and postpartum hemorrhage have been said to ensue. Evidence on most of these points is, however, incomplete.

Iron and other Blood-forming Factors Women, during the years from puberty to the menopause are particularly liable

who has shown experimentally that a diet deficient in this substance, especially if continued throughout several pregnancies, leads in the offspring to simple goitre, the gland being hyperplastic, devoid of colloid, and with a large blood supply. Simple goitre in the mother too, may follow numerous pregnancies owing to the call of the foetus on her stores of iodine. He believes that the development of simple goitre in later life may be prevented by the supply of an adequate amount of iodine (0.1 mg. daily) to the mother during pregnancy and lactation, and to the child throughout the years of growth. This may be ensured by eating sea fish twice weekly during pregnancy and lactation, or by cod liver oil, the use of which should be continued throughout childhood and adolescence. The importance of the use of iodised table salt as a preventive of congenital goitre in "goitre areas" is referred to elsewhere (p. 460).

Other Minerals. Little is known regarding other mineral requirements in pregnancy, though it is probable that several, such as copper (which may be necessary for the development of the red blood corpuscles), sodium, potassium, manganese, magnesium and sulphur are important. Studies of sodium, potassium and sulphur balances have shown that the intakes of these substances are usually adequate for the foetal needs.

Vitamin Requirements

In pregnancy there is a greatly increased demand for vitamins as compared with the non-pregnant adult. This increased demand is illustrated by the fact that *beri-beri*, a disease due to deficiency of vitamin B, and which is endemic in certain countries where the diet consists largely of polished rice, is more liable to attack pregnant women. Then there are the observations of Birnbacher, who found that night blindness (*hemeralopia*), which in Vienna during the years 1918—1923 arose from lack of vitamins A and D, was much more frequent in pregnancy, especially in the later months, and in women bearing heavy children.

Though there is in this country little tendency to the development in the adult, whether during pregnancy or at other times, of frank and recognised deficiency diseases such as beri-beri, pellagra and osteomalacia, there can be little doubt that vitamin deficiency is often manifested in the development of many of the minor ailments of pregnancy—ailments so common that they are almost regarded as normal, while an increasing number

to become anæmic. This is partly due to blood loss at menstruation and partly to the demands of the fetus for iron during pregnancy (p. 400). The liver of the new born child contains weight for weight five times as much iron as that of an adult. As the iron content of milk is poor this is no doubt a provision for the early months of postnatal life. This store of iron is laid down chiefly in the last three months of pregnancy and it is therefore then that anemia is liable to become most marked. So an adequate supply of foods rich in iron is necessary at this time such as liver and kidney, lean red meat, dried fruits such as peaches, apricots and prunes, eggs (especially valuable) and green leafy vegetables particularly turnip tops. Treacle too contains a great deal of it. White meats, fish, margarine and cereals especially when milled are all poor in iron. Unfortunately amongst working women a diet consisting mostly of bread, tea, margarine, potatoes and fish is all too common. The average diet in this country contains about 10 mg. of iron daily but in pregnancy at least 90 mg. are necessary. In the last two months the iron content of the fetus increases from 80 to 400 mgm. which amounts to a storage of 3 mg. daily. Should a proper diet be unattainable it may be advisable to supplement it by the medicinal administration of iron and this should always be done if the hæmoglobin percentage falls much below 90. It may be given in the form of Bland's pill 60 gr. daily. To ensure its absorption it is best given in the form of a powder or if preferred ammoniated citrate of iron may be prescribed. The British Pharmacopœia dose is however useless. It must be given in doses of 90-120 gr. daily.

As will be seen later however, when we come to discuss the relation between changes in the gastric secretion and the anæmias, deficiency of iron is not the sole cause even of the simple anæmias of pregnancy. For the development of the fully formed red blood corpuscle including its hæmoglobin from the primitive megalocytes of the bone marrow some specific nutritional factor is necessary and this is normally elaborated from the food by the gastric juice. It is usually possible to ensure an adequate supply of this factor even when the gastric secretion is defective by adding calf's liver to the diet once or twice weekly though if there is complete achlorhydria it should be given much more frequently.

Iodine. The importance of a sufficiency of iodine in the diet during pregnancy has been recently emphasised by Mellanby

who has shown experimentally that a diet deficient in this substance, especially if continued throughout several pregnancies, leads in the offspring to simple goitre, the gland being hyperplastic, devoid of colloid, and with a large blood supply. Simple goitre in the mother too may follow numerous pregnancies owing to the call of the foetus on her stores of iodine. He believes that the development of simple goitre in later life may be prevented by the supply of an adequate amount of iodine (0.1 mg. daily) to the mother during pregnancy and lactation, and to the child throughout the years of growth. This may be ensured by eating sea fish twice weekly during pregnancy and lactation, or by cod liver oil, the use of which should be continued throughout childhood and adolescence. The importance of the use of iodised table salt as a preventive of congenital goitre in 'goitre areas' is referred to elsewhere (p. 460).

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Effects of Deficiency B_1 is the anti neuritic vitamin and deficiency is manifested chiefly in beri beri—a disease occurring among rice eating peoples of India Japan and the East and West Indies where the food consists largely of highly milled rice from which the germ and pericarp have been removed or in Newfoundland and Labrador where it is due to the extensive use of white flour. In pregnancy B_1 deficiency is liable to lead to polyneuritis (p. 416) and possibly to constipation. It is conceivable that it plays a part in the causation of other lesions or disorders that are dependent on atony of unstriated muscle or on its defective innervation such as pyelitis cholelithiasis or uterine inertia. There is reason too to believe that it plays some part in the causation of eclampsia for in 150 cases of avitaminosis B_1 in pregnancy recently reported by Gordon King from Hong Kong there were 16 cases of eclampsia—an incidence over 50 times the normal.

B_2 is the antidermatitis vitamin and gross deficiency is manifested in pellagra. In pregnancy B_2 deficiency probably has to do with the causation of macrocytic anæmia (p. 402). The body seems to have little power to store either B_1 or B_2 and so the effect of a deficiency of these vitamins in the diet is quickly felt.

The Technical Commission on Nutrition of the League of Nations in its report of June 1938 recommends an allowance of 600 to 900 international units of B_1 for the pregnant and lactating woman. These quantities of B_1 would they state probably be contained in ordinary mixed diets when lightly milled cereals are a staple of the diet or when milk fruits and vegetables are freely used and highly milled cereals and sugar are not allowed to displace protective foods.

Vitamin C (Anti scorbutic)

Properties and Distribution Water soluble very sensitive to heat. Found chiefly in green leaves such as cabbage lettuce watercress in potatoes and in fresh fruit especially the citrus group—oranges lemons and grape fruit. Milk is a valuable but by no means rich source of it. Vitamin C is largely destroyed by boiling but potatoes retain a fair amount of it even after boiling.

Deficiency in pregnancy may lead to abortion or absorption of the foetus or to various manifestations of scurvy (p. 376). The capillary endothelium becomes swollen and degenerate resulting in stagnation of blood in the capillaries. The child may be born with scurvy. Deficiency may have to do also with the causation

of severe anæmia of pregnancy and may play a part in the causation of some cases of accidental hæmorrhage, etc (p 251) One large orange daily, or 1 ounce of orange juice, is sufficient for the needs of the pregnant woman

Vitamin D (Calcifying and Anti rachitic) This vitamin has the important function of controlling the deposition of calcium and phosphorus in the tissues. As the bones and teeth are largely composed of calcium phosphate it is evident that their structure is determined in a high degree by the adequacy of vitamin D in the diet. Like vitamin B the body has little power to store it, and is therefore dependent on outside sources for its supply, though it is formed in the skin by exposure to sunlight

Properties and Distribution Fat soluble and thermostable. Its distribution is very limited for the only natural substances known to be rich in it are egg yolk and cod and other fish liver oils. Milk, cream, cheese and butter contain small but variable amounts and much more in summer than in winter and from grass fed than from stall fed cows. One teaspoonful of cod liver oil has as much vitamin D as a pint of fresh milk but the content of milk is much increased by irradiation. Green salads and vegetables contain appreciable quantities, but only when freshly cut, by the time they are purchased from the retail shops they may contain practically none. Vitamin D is formed in the skin by exposure to sunshine, from ergosterol, which exists there as an impurity in cholesterol. Exposure of the naked body to sunshine can therefore make up for deficiency of vitamin D in the diet and in winter, when sunshine is lacking in northern climates a greater provision of vitamin D in the form of cod liver oil is essential both in pregnancy and in infancy and childhood

Effects of Deficiency Most of our knowledge regarding this comes from experimental work on animals. Korenchevsky (1922) and Goldblatt (1923) found that if cod liver oil the richest source of vitamin D, was given in pregnancy and lactation, the young did not get rickets even if they were afterwards fed on diets totally devoid of vitamin D. The following experiment by Mellanby (1926) also points to its value in pregnancy. Two pregnant bitches were taken. One was given cod liver oil in pregnancy and lactation, and the other olive oil. After weaning the puppies were divided into six pairs, each containing one from each mother, and all were given a diet designed to cause rickets. In each pair the puppy from the mother that received no cod liver oil in pregnancy got severe rickets while the other did not. If, instead, cod liver oil were given to both puppies the bones developed normally.

After four months of this normal diet, when the animals were well grown, the diet of this pair was changed to one with a minimal amount of vitamin D and a rickets producing cereal. After six months of this the puppy whose mother had not had cod liver oil developed rickets and the other did not.

It is not yet certain how far these results are applicable to human beings, and in what degree protection against rickets can be afforded by the administration of vitamin D to pregnant and nursing women. Hess and Weinstock tried the effect of cod liver oil in the last two months of pregnancy and concluded that there was no appreciable effect, for almost all the infants got rickets.

Vitamin D and Dentition M. Mellanby found that cod liver oil given in pregnancy and lactation influenced the character of both the deciduous and permanent teeth. If puppies were fed on an adequate diet after weaning including a sufficiency of vitamin D the character of the previous maternal feeding had only a slight influence on the development of the permanent teeth, but if the diet was deficient after weaning they were more likely to develop caries if the mother had not received an adequate amount of vitamin D in pregnancy and lactation. These results therefore, show that the principles of maternal feeding found to operate in the case of experimental rickets operate also in determining the structure of the teeth.

It is not of course claimed that even an adequate amount of vitamin D and calcium in pregnancy and lactation is enough in itself to ensure freedom from rickets and dental caries in growing children. It is also necessary to give the child cod liver oil and at least a pint of milk daily throughout the years of growth and adolescence. Hereditary influences, too, probably play a part, thus Lenz states that in a pair of uniovular twins caries tends to affect exactly the same teeth. "We must suppose that owing to defects in the genes the teeth have weak spots in the enamel where the resistance to caries is inadequate."

Vitamin E (Anti sterility)

Properties and Distribution Fat soluble and thermostable. Occurs chiefly in the germ of wheat and oats and to a less extent in egg yolk, milk butter fresh green leaves especially lettuce, fruit and meat.

Effects of Deficiency Absence causes sterility in experimental animals and if conception takes place death and resorption of the foetus follows. In the male its absence leads to degeneration of the germ cells in the testis. Its mode of action is unknown but

its use in cases of habitual abortion where other causes can be excluded is indicated (p 209) Shute claims that vitamin E deficiency is a cause of accidental hæmorrhage (*abruptio placentæ*) and that this condition can be prevented by large doses of wheat germ oil No confirmation of this claim seems to be yet forthcoming

Vitamin K (Koagulation vitamin)

Properties and Distribution Fat soluble, found in alfalfa, hog's liver, decayed fish, meal, hemp seed, spinach, kale and other green vegetables

Effects of Deficiency Absence in chicks causes multiple hæmorrhages These have not been produced in mammals, as the vitamin can be formed by bacteria in the lower bowel whereas from the lower gut in chicks no absorption occurs Vitamin K is in some way necessary for the formation of plasma prothrombin which is, of course an essential factor in blood clotting In obstructive jaundice and chronic biliary fistulæ in which bile is absent from the intestine, vitamin K being fat soluble cannot be absorbed, and a hæmorrhagic tendency results Recent work on prothrombin values has shown that (1) there is no difference between the plasma prothrombin levels of pregnant and non pregnant women, (2) the plasma prothrombin level in the normal full term infant varies between 14 per cent and 39 per cent (Brinkhous, Smith and Warne) of that of the mother and gradually rises and reaches adult level by the end of a year (3) In premature infants the level is still lower, the average being about 11 per cent of the adult figure (Hellman and Shettles) (4) In hæmorrhagic disease of the newly born the level may be as low as 5 per cent (5) The level in all infants is at its lowest from 48 to 72 hours after birth (Waddell and Guerry) in keeping with the fact that hæmorrhagic disease of the newborn does not set in after the fifth day Furthermore, by administration of vitamin K to the pregnant woman during the last month of pregnancy or even as late as four hours before delivery the plasma prothrombin of the infant can be raised several fold Indeed, the prothrombin levels so reached are higher than those obtained by direct administration to the infant after birth (Shettles, Delfs and Hellman)

This work has an important bearing on the prevention of still birth and neo-natal death While there is no doubt that trauma

during delivery is the main primary cause of serious intracranial and other hæmorrhages it is probable that a hæmorrhagic tendency increases the actual amount of bleeding through continued oozing. It is well known from clinical experience that premature infants have a greatly increased tendency to fatal hæmorrhage usually cerebral and that this may occur even in easy and spontaneous delivery. The delicacy of the walls of the capillaries probably accounts in part for this but another factor no doubt is the low plasma prothrombin that is characteristic of the premature infant. Hellmann Shettles and Eastman gave vitamin K in a single dose of 2 mgr. of the synthetic preparation by mouth to mothers during labour using alternate cases as controls. Altogether 384 women received vitamin K and the control series numbered 392. Among the infants of the mothers who received vitamin K there were six still births or neo-natal deaths (1.5 per cent) and among the infants of the control series there were sixteen deaths (4.1 per cent). At post mortem examination hæmorrhage was demonstrable in only one of the six fatal cases a difficult breech delivery. In the control series hæmorrhages in one or other organ was demonstrated in nine (26 per cent). There is evidence that many anaesthetics and analgesics including nembutal phenobarbitol (luminal) and other barbiturates depress the prothrombin levels in mother and child by causing damage to the liver in which prothrombin is formed. The value of vitamin K in treatment of hæmorrhagic disease of the newborn is too well known to need discussion here.

The Cereal Toxamine Theory It is claimed by Mellanby that excess of cereals especially oatmeal may interfere with the deposition of calcium in bones and teeth. The evidence for this view has however been severely criticised anyone who knows the crofters and farm labourers of north-east Scotland in whom good teeth straight limbs and strong physique are the rule although oatmeal porridge and milk form an important part of their dietary, might well doubt whether such experimental results can be applied to man. McCulloch of the Dietetic Research Laboratory, Nigeria reviewing the evidence, condemns the conditions under which the experiments on which the so-called cereal toxamine theory is based were carried out and maintains that up to the present no evidence has been produced that cereals are actively harmful.

In any case it will comfort those who like their plate of morning

SUMMARY TABLE

TABLE IV. *Daily Human Requirements in Pregnancy and Lactation (a) as Estimated by Garry and Stuenkel, and (b) as Recommended by the League of Nations Technical Commission.*

	Standard Requirement for Women	In Pregnancy	Percentage Increase over Standard	In Lactation	Percentage Increase over Standard
Calories (a)	2,100 + 300 for work	2,500 + 300 for work At term 2,100 + 300 for work	18	2,700 3,200 + 300 for work	25-50
(b)	2,400 + 50 per hour of work 64 gm 1 gm per kg body weight 80 gm	2,400 + 50 per hour of work 70 110 gm 2 gm per kg body weight 100 gm or more	11	3,000 + 50 per hour of work 84-104 gm 2 gm per kg body-weight Over 100 gm	20
Protein (a)	64 gm	70 110 gm	10 86	84-104 gm	30-63
(b)	1 gm per kg body weight	2 gm per kg body weight	100	2 gm per kg body-weight	100
Fat (a)	80 gm	100 gm or more	25 or more	Over 100 gm	Over 125
(b)	0.68 gm	1-2 gm	50 200	1-2 gm	50-400
Ca (a)	—	2 gm	—	2 gm	—
(b)	1.23 gm	Up to 2 gm	Up to 60	Up to 2 gm	Up to 60
P (a)	11.5 mg	18 mg	60	12.5-15.5 mg	9 35
(b)	—	9 000 I U	—	9 000 I U	—
Vitamin A (a)	—	900 900 I U	—	400-900 I U	—
(b)	—	870-1 120 I U	—	870 1,120 I U	—
Vitamin B ₁ (a)	—	110 I U	—	340 I U	—
(b)	—	Chief source wheat germ	—	—	—
Vitamin C (a)	Important				
(b)					
Vitamin D (a)					
(b)					
Vitamin L					

A PROTECTIVE FOODS

TABLE V¹—*Dietary Scheme for the*

Food	Amount	Protein	Calcium	Phosphorus	Iron	Iodine
	Grammes				Milligrammes	
Milk	1 000	32	12	0.0	2.4	0.02 0.05
Meat (or fish or poultry)	120 (a)	22	—	0.3	$\frac{5.0}{2(a_1)}$	—
Eggs (one)	50	6	—	0.1	1.5	—
Cheese (c)	30	8	0.3	0.2	0.4	—
Green and Leafy Vegetables	100 (d)	1	0.1	—	1.2	—
Potatoes	250	6	—	0.2	2.0	—
Legumes Dried	10 (e)	2	—	—	0.2	—
Cod liver Oil	30	—	—	—	—	Richest source
An available source of Vitamin C (from raw fruits and vegetables)						
Total yield		7	1.6	1.7	10.2	Ade- quate

B SUPPLEMENTARY ENERGY YIELDING FOODS BY MEANS OF WHICH THE INDIVIDUALS

Cereals as needed— Highly milled or Whole grain	250 (f)	28	—	0.2	2.5	
	250 (g)	—	0.1	0.9	9.0	

Fats as needed
Sugar as needed

¹ The estimates are based on data in Sherman's "Chemistry of Food and Nutrition" protein and 3.5 per cent. fat. The figures for vitamins however are converted to inter-

Pregnant and Nursing Woman.

Vitamin A	Vitamin B ₁	Vitamin B ₂	Vitamin C	Vitamin D	Calories	Remarks
International Units			International Units			
Rich (1,000-3,000)	Good (50-75)	Rich	Poor	Poor	660	(a) Calculations for lean meat.
Poor	Poor (b)	Rich	Poor	None	240	(a ₁) One-half calculated as available iron.
Rich 1,000-1,500	Good (about 15)	Rich	None	25-40	70	(b) Except glands (liver and kidneys) and pork muscle
Rich (800-1,000)	Poor	Good	Poor	Poor	125	(c) Calculated as Cheddar cheese
Rich (1,000-1,500)	Good	Good	Poor	None	30	(d) Estimated on basis of $\frac{1}{2}$ cabbage, $\frac{1}{2}$ lettuce, $\frac{1}{2}$ spinach
Poor	Good	Good	Good	None	250	(e) Calculated as beans.
Poor	Good	Good	None	None	35	
Rich (1,800-3,500)	None	None	None	Rich (about 300)	30	
			To yield 250-500			
Over 5,000	Over 150	Adequate	Over 500	About 300	1,440	.

ENERGY REQUIREMENTS CAN BE MET

	Rich (about 250)				1,000	(f) Calculated as white flour.
					1,000	(g) Calculated as whole wheat

4th edition, 1933. The figures for milk are calculated for a content of 3.2 per cent. international units and must be regarded as rough approximations only.

porridge to know that its evil effects can be entirely obviated by eating it with plenty of milk, or by a daily dose of cod liver oil !

Fluids It is usually advised that at least 2 pints of water in some form, either plain water or as orangeade or lemonade, should be drunk daily in addition to the fluids drunk at meal times in tea coffee etc., in order to "flush the kidneys" and thus get rid of toxins. There is, however, considerable evidence that there is a great tendency to oedema in pregnancy, and that the oedema may be the starting point of pre-eclamptic toxæmia. We hold therefore that the pregnant woman should not consume extra fluids but should drink less than before pregnancy. This is we believe, especially important from mid pregnancy onwards as it is then that oedema is apt to become clinically important. For the same reason, and as it leads to the storage of fluid in the tissues, the consumption of common salt should be limited as much as possible.

Daily Requirements in Pregnancy and Lactation

The daily requirements in pregnancy and lactation of the various foodstuffs and vitamins are summarised in Table IV on page 67.

The succeeding table (Table V, p. 68) containing details of specimen diets will be found convenient for reference. It has been compiled by the Health Committee of the League of Nations from investigations made in Great Britain, the United States and Scandinavian countries, and is considered satisfactory for a pregnant or nursing woman.

Summary of General Principles

From what has been said, the following general principles may be deduced regarding the constituents of an adequate diet for the expectant mother —

(1) Provided the diet has been a mixed and generous one, no appreciable increase in its quantity is necessary in pregnancy.

(2) At least half the protein should come from animal sources, viz., meat, milk and eggs.

(3) Care should be taken that sufficient calcium and phosphorus are provided for the proper formation of the fetal skeleton and teeth. The best source of these is milk, of which at least 2 pints should be taken daily. This may include that taken

in junkets, custards, etc. Other less important sources of calcium and phosphorus are oatmeal, whole meal bread, fruits, vegetables and green salads.

(4) To provide the small quantities of iodine necessary sea fish should be eaten twice weekly. Fish liver oil also contains it in large amounts, and is a good substitute if taken daily.

(5) The diet should contain a plentiful supply of all the vitamins. To ensure this there should be eaten daily fresh green vegetables and salads, including lettuce, spinach, cabbage, brussels sprouts or green peas, tomatoes, carrots, potatoes, fresh ripe fruit, and dairy produce—eggs, milk, butter and cheese. Liver should be eaten once weekly.

(6) Because of the prevalence of rickets and dental caries, vitamin D is probably by far the most important of all the vitamins in pregnancy and lactation, for it is needed to ensure the utilisation of calcium and phosphorus, and their deposition in the developing bones and teeth of the foetus. Its distribution in foodstuffs is very limited, for only egg yolk contains any considerable amount of it. It is advisable, therefore, to give 2 tea spoonfuls of cod liver oil, or an equivalent quantity of halibut liver oil, daily.

(7) The quantity of fluids and of common salt should be strictly limited.

(8) The diet should contain sufficient roughage to prevent constipation. In addition to that in fruit, vegetables and meat, whole meal bread and oatmeal porridge (eaten with milk at breakfast) are useful and effective.

Diet List for General Use The following is a list of suitable articles of food from which a selection may be made —

Meats Beef, mutton and lamb in moderation, and not more than once daily, bacon, sea fish, chicken and game. Liver is a valuable addition to the diet. As a rule pork and veal are better avoided as being indigestible. Fried meats and fish are liable to cause acidity (heartburn) and are better avoided as far as possible.

Soups and Meat Extracts (such as beef tea, chicken soup or other beef juice preparations). These have no direct value as foods, but stimulate appetite because of their pleasant flavour. They may therefore be taken in moderation, but it should be remembered that they contain extractives which, if taken in excess, may be harmful.

Vegetables Potatoes, turnips, carrots, cabbage, spinach, beet-root, peas, beans, tomatoes, may usually be eaten with safety, but

brussels sprouts cauliflowers cucumbers parsnips and radishes should be partaken of with moderation and should be well cooked preferably by steaming rather than boiling as otherwise they are liable to upset digestion

Fruits Ripe apples oranges peaches, apricots, pears, plums prunes, strawberries, raspberries currants, cherries figs, grapes pineapples and grape fruit Some of these should be eaten daily In addition to supplying necessary accessory food factors they act as gentle and natural laxatives, this laxative action is more marked if the fruit is taken by itself rather than as part of a meal and if eaten raw, though if preferred it may be stewed

Bread Fresh bread pastry and cake should be avoided as far as possible Whole meal bread is better than white

Cereals Oatmeal porridge is valuable as a food and especially if eaten at breakfast helps to maintain regular action of the bowels It should be well boiled and eaten with plenty of milk (which tends to neutralise any anti calcifying action of the oat meal) Rice sago tapioca arrowroot and custards are in moderation harmless, and are easily digested Their anti-calcifying action should be borne in mind

Milk eggs, butter and cheese are excellent, wholesome and harmless foods The first three especially should always enter generously into the diet of every pregnant woman. At least 1 pint of milk and one egg should be taken daily

Fluids These should be limited (see p 70)

Tea and coffee should be taken only in moderation and if sleeplessness is at all troublesome they should never be taken at night cocoa or hot milk being as a rule much better at this time

Alcohol is better avoided altogether unless it is specially indicated

As a general guide to diet in pregnancy and lactation Mellanby states that it should include the following —

2 pints of milk daily

One or two substantial servings of green vegetables cabbage spinach or lettuce daily

One or two eggs or egg yolks daily

An apple or orange or some fresh fruit daily

Sea fish twice or more a week

Calf's liver once a week

If cod liver oil can be taken, two teaspoonfuls daily are advisable Halibut liver oil is equally good and has the advantage

that it is smaller in bulk and can therefore be taken in capsules, each of which contains 2 minims

The rest of the diet can be made up as the woman wishes

Exercise

Regular exercise in the open air is important for the pregnant woman. It promotes sleep, helps digestion, keeps the muscles in a healthy condition and encourages a cheerful frame of mind. Most expectant mothers get a fair amount of exercise in looking after their houses, but this, though often tiring, is scarcely the best form of exercise, and an effort should be made to spend at least an hour or two daily in the open air. Bedroom windows should be kept open at night for at least 10 or 12 inches, no matter what the weather may be like. All violent exercises such as tennis, riding, cycling or swimming should be avoided during the last six months. Speaking generally, the amount of exercise should be regulated by the patient's own feelings and should always stop short of fatigue. There is no reason why household duties should not be continued till the end of pregnancy provided the rule regarding over fatigue is observed, but women employed in factories should give up their work at least six weeks before term, so that they may get more intervals for rest and time for outdoor exercise.

Rest and Sleep

Rest While exercise is important a proper amount of rest is even more so. Especially during the latter half of pregnancy, at least two or three hours should be given up every afternoon to rest on a couch or bed, if possible in a quiet room. The feet should be raised to the same level as the body and all tight clothing loosened. Towards the end of pregnancy rest periods will have to be more frequent.

Sleep There should be at least eight hours' sleep every night in an airy room with open windows. The bed clothes should be as light as is compatible with warmth. If the house is large enough the patient should have a bedroom to herself.

Bathing

The morning bath should be tepid, but there is no objection to a hot bath at bedtime. If, on account of unsuitable home conditions, it is impossible to get a daily bath a sponge down with soap and water makes a fairly satisfactory substitute. In

the last two months of pregnancy this daily sponge down is to be preferred to the full bath as with the latter there is some danger of the bath water getting into the vagina where it might be a potential source of puerperal sepsis. Sea bathing may be indulged in during the early months, unless there is some reason to forbid it, such as a tendency to miscarriage, but in the last half of pregnancy it is unsafe.

Travelling

Speaking generally, travelling is safe during the first half of pregnancy, but in the later months it should be as much restricted as possible and always at the times corresponding to the monthly periods. Sometimes journeys cannot be avoided and every woman must be a law to herself with regard to them. Long journeys are, however, not advisable in the last four weeks of pregnancy nor at any time if there has been a tendency to miscarriage. So much depends on the degree of comfort with which the journey can be completed, and on the special peculiarities of each patient, that it is impossible to lay down more than general rules.

Care of the Teeth

Regular cleansing of the teeth important at all times in maintaining perfect health, is especially so in pregnancy. Their cleansing at least night and morning should be enjoined, but better still after each meal. A good cleansing material is prepared chalk or even bicarbonate of soda. Teeth that are decayed should be filled or extracted at once.

Care of the Breasts

Preparation of the breasts for suckling should begin about the sixth month. If the nipples are flat they should be drawn out by the finger and thumb for a short time each day, using a little lanoline as a lubricant. The nipples too should be kept clean by daily washing with soap and warm water to get rid of the crusts of dried secretion that tend to form on them. If towards the end of pregnancy the breasts feel uncomfortably heavy, they may be supported by a sling but they should never be tightly constricted or subjected to constant pressure. -

Care of the Bowels

(see Constipation, p. 376)

Clothing

The amount and kind of clothing to be worn depends so much on climate and season that it is not possible to do more than lay down some general rules. It should be warm enough to guard against chills, sufficiently loose to allow free movement of the limbs and free breathing, and should not tightly compress the abdomen or breasts. If corsets have been worn they need not be left off, but should be so chosen as not to compress but rather support the abdomen and breasts from below. "They should be made of soft materials with elastic insertions and side as well as front or back lacing, and should extend well down in front and fit snugly over the hips. The front lace corset is usually found to be the most satisfactory for the patient may lace it from below upwards while lying on her back. This enables her to draw it in snugly about the hips, below the abdomen and to adjust the garment to the abdominal curve, so as really to support without compressing the uterus" (Von Blarcom.)

In the last weeks of pregnancy even the best-fitting corsets may be uncomfortable, and an abdominal binder, which can be home made, may be devised in order to give support to the large abdomen. The centre which supports the abdomen should be wide and the ends narrow. The ends are crossed behind the back, brought round in front and pinned to the lower margins. A similar binder may be made if required for support of large breasts. The brassière which has for its object the flattening of the breasts should never be worn, as it is liable to flatten the nipples and interfere with the blood supply of the breasts, thus making suckling difficult or impossible.

As far as possible all clothing should hang from the shoulders and suspenders should be worn in place of garters which are liable to cause varicose veins. Shoes should be made of strong leather, be easy fitting and have sensible low heels and good thick soles, so that walking may be free from the slightest discomfort. High heels and thin soles, undesirable at all times are especially so in pregnancy when brisk walking exercise is so essential to health.

Marital Intercourse

Marital intercourse should be avoided in the last three months of pregnancy, for there is reason to believe that thereby dangerously virulent organisms that might cause puerperal sepsis may be introduced into the vagina. If there is a tendency to abortion

or miscarriage it should be prohibited throughout the entire pregnancy

REFERENCES

- BIRNBACHER T R and LAFTEN E. *Zeitschr f Augenheilkunde* 1923 51 309
 BRINKHOUS H M SMITH H P and WARNE E. D. *Amer Jour Med. Sci* 1937 193 475
 COONS C M and BLUNT K. *Jour Biol Chem* 1930 86 1
 GARRY R C and STIFFENS D. *Nutrit on Abstracts and Reviews* 1935-36 5 855
 GOLDBLATT H. *Biochem cal Journal* 1923 17 298
 GREEN H N and MELLANBY E. *Brit Med Jour* 1928 ii 691
 GREEN ARMYTAGE V B. *Ind Med Ger* 1928 63 357
 HELLMAN L M and SHETTLES L B. *Bull Johns Hopkins Hosp* 1939 65 138
 HELLMAN L M SHETTLES L B and EASTMAN N J. *Amer Jour Obst & Gyn* 1940 40 844
 HESS A F and WEINSTOCK M. *Am Jour Dis Child* 1924 27 1
 KORENCHESKY V. *Med Research Council Reports London* 1922 No 71
 KORENCHESKY V and CARR M. *Jour Path and Bact* 1923 26 389
 LENZ F. *Human Heredity* by DAUR FISCHER and LENZ. Allen & Unwin 1931 213
 McCULLOCH W E. *Brit Med Jour* 1932 i 75
 McILROY A LOUISE. *Proc Roy Soc Med* 1935 28 1385
 MAXWELL J PRESTON. *Proc Roy Soc Med. London* 1929-30 23 Part I. 639
 MAXWELL J PRESTON. *Proc Roy Soc Med Londo* 1934-5 28 265
 MAXWELL J PRESTON PI H T LIN H A C. and Kuo C. C. *Proc Roy Soc Med London* 1939 32 287
 MELLANBY E. *Brit Med Jour* 1926 i 515
 MELLANBY E. *Lancet* 1933 ii 1131
 MELLANBY E. *Ed n Med Jour* 1933 40 197
 MELLANBY M. *Trans Fd n Obst Soc* 1928-9 49 25
 MELLANBY M. *Med cal Research Council London Special Report Series* No 140 1929
 MELLANBY M and PATTISON C L. *Brit Med Jour* 1932 i 507
 PROCHOWNICK L. *Centralbl f Gynäk* 1889 13 577
 SHETTLES L B DELFS E and HELLMAN L M. *Bull Johns Hopkins Hosp.* 1939 65 419
 SHUTE E. *Amer Jour Obst and Gyn* 1938 35 970
 THEOBALD G W. *Lancet* 1930 i 1115
 THEOBALD G W. *B.M.J* 1933 ii 376
 THEOBALD G W. *Proc Roy Soc Med London* 1935 28 1388
 TOVERUD K. U and TOVERUD G. *Acta Paed africa* 1931 12 Suppl II
 WADDELL W W and GUERRY DU PONT. *J A M A* 1939 112 2259
 ZISKIN DANIEL E and HOTELLING H. *Jour Dental Research* 1937 16 507

CHAPTER V

THE INFLUENCE OF THE EMOTIONS UPON PREGNANCY AND PARTURITION

By GRANTLY DICK READ, M.A., M.D (Cambridge)

DURING recent years the influence of the mind upon the body has been more fully recognised. Functions which may have been considered purely mechanical have been found dependent upon facts which cannot be explained by any mechanistic theory.

The human race has rapidly been drawn into the whirl of civilisation and culture. Time, space and environment have demanded a readjustment of mental activities out of all proportion to any physical evolutionary change that has taken place.

The relative imbalance between impulses emanating from the higher nervous centres and the reactions to them in the muscular systems, is probably the cause of many and various pathological conditions which exist to-day. Normally harmony exists between nerve and muscle so that in the performance of any natural function a given stimulus produces an adequate result for the completion of that function without pain or shock.

Labour, however, in the modern woman is a natural function apparently attended by very considerable pain, difficulty and danger. There is no evidence that reproduction was ever intended to be painful. There is, however, evidence to show that in the evolution of the human body the uterus during normal labour was not expected to cause pain.

The human body is so constructed that where it is exposed to injury, special nerve receptors are placed to convey afferent impulses to the brain of such character that efferent motor stimuli are immediately called into play for the protection of the part receiving the injury. These receptors are called by Sherrington¹ 'nociceptors' they are to be found in all the exposed parts of the body but on the other hand they are absent in those places where the bony structure of the body protects the tissues completely, such as the brain and the spinal cord.

The only nociceptors that can be demonstrated within the uterus are those which receive stimuli from tearing or lacerating,

¹ The Integrative Action of the Nervous System Sherrington.

or an effort to tear or lacerate. It is concluded, therefore, that where there is uterine pain during labour, tearing, laceration or tension is the cause of that pain, for no other stimuli are carried to the centres of pain perception.

Upon this assumption investigation has been made in order to show why there is greater tendency for pain to occur during normal labour in cultured women than there is in uncultured and more primitive races. Emphasis must be laid here on the fact of *normal* labour, for it is presumed that in all abnormal labour pain must essentially occur.

The anthropomorphologists find no evidence to show that the relative size of the foetal head to the maternal pelvis increases with the advance of culture. There is no reason to believe that the uterine muscle of the primitive is any more efficient than the uterine muscle of the cultured, and even if the skeletal muscles of the primitive woman are stronger, they are not brought into play until after the stage during which the cultured woman experiences most of her pain.

The pain of normal labour in the cultured woman must therefore be considered as arising from some change other than physical, and since culture itself is primarily based on the development of mental activities it is reasonable to suppose that to a large extent the pain of labour is consequent upon a similar development. In other words, the harmony between muscle and nerve is disturbed, so that somewhere in the serial operation of parturition the mechanism breaks down.

The Emotions of Normal Labour in Primitive Woman

To those who have had the opportunity of watching the birth of a child of a primitive mother there appear to be three definite instincts:

- (1) The instinct of self assertion which gives rise to the emotion of elation, which is shown by the happiness of the girl about to bring forth her child.
- (2) The instinct of reproduction is present only in a small degree, but in some cases is clearly to be observed early in the first stage.
- (3) The parental instinct and its accompanying emotion of tenderness. This is the most striking of all.

(1) and (3) are frequently seen very definitely in the labour of the primitive woman, and there is no question of confinement

other than a short sojourn of only a few hours away from her fellow creatures. The whole atmosphere in this case is one of pure tenderness possession protection and what in the cultured woman might appear to constitute agonising pain is looked upon in the primitive woman as that which is essentially hard work. Discomfort possibly but pain is considered of minor importance.

Fear in the Cultured Woman

In the cultured woman the above three emotions may be traced from time to time particularly in primiparæ but they are practically negligible before the overpowering influence of the instinct of flight, which is accompanied by the emotion of fear.

It is from fear that labour has so justly earned the reputation of being an agonising procedure. Under the influence of fear it is agonising. But that is not all. This strong and irresistible emotion disorganises the neuro-muscular harmony of the function until it can almost be said that the large majority of labours in cultured women are abnormal.

The question of fear needs very careful consideration. What is it that makes a woman afraid? In many cases it would be difficult to obtain any verbal corroboration that fear is present *until labour has actually commenced*. It is in the nature of woman to be brave and not to allow those about her to know what is going on in her mind. But investigation has shown that very few women indeed—exceptions do occur—become pregnant and go through the pregnancy come into labour and arrive at the end of the second stage without the most terrifying apprehensions and doubts.

* These doubts are supported by evidence which has come down to woman through the ages of civilisation. She has heard of the agonies endured by her friends and relations—even mothers will warn their daughters of the terrors with which they are about to be faced. Contractions of the uterus are known as *pains*, both the Bible and the Prayer Book add solid weight of apparent fact to the mental and physical horrors that accompany childbirth.

It is not unusual too that special emphasis has been laid upon the death of infants the mothers who have died in childbirth the babies who have been born deformed and so on. One of the rarest remarks to hear about labour is that which concerns the

joy of production. Woman is still sufficiently simple in her pride to endeavour to elicit sympathy for the experience through which she has passed so nobly. Conscious or subconscious fear must be accepted as an almost invariable emotional influence in the mind of the pregnant woman.

Fear reacts upon the neuro-muscular harmony of labour in a very different manner. In order to see clearly how this takes place we must consider three essential factors —

- (1) The construction of the uterus
- (2) The nerve supply of the uterus
- (3) The manner in which the emotion of fear influences the neuro muscular harmony

(1) Quite briefly the uterus consists of three chief layers of muscle fibres at full term the circular fibres which are chiefly arranged about the cervix and lower uterine segment and practically absent in the upper third the intermediate mixed fibre layer in which fibres run in all directions, and the tremendously lengthened and strengthened longitudinal fibres which lie in the long axis of the uterus and which by contraction and retraction expel the child.

It will be remembered that the circular fibres of all the outlet apertures of the body are placed there in order to close and open that outlet such as the sphincter ani sphincter urethrae and also that the longitudinal fibres are used for shortening and thereby driving out the contents of the organ to be evacuated.

This applies to the uterus as does the general principle that when there is a stimulus to evacuate the contraction of the muscles of the outlet is inhibited whilst the contraction of the expelling muscle occurs as in defaecation when the sphincter ani relaxes in order to allow the expulsion of faeces from the rectum.

(2) The nerve supply to the uterus speaking generally, is on the following lines —

The sympathetic nerves to the uterus are motor to the circular muscle fibres and inhibitory to the longitudinal bundles whereas the sacral autonomic through the pelvic nerve is motor to the longitudinal fibres and inhibitory to the circular fibres. The impulses through the pelvic nerve are so inadequate that some authorities doubt whether they really influence labour. It is the power to contract and retract irrespective of nerve stimulus

that the longitudinal fibres possess that is the essential factor in emptying the uterus

In normal labour it is probable that the influence of the pelvic nerve is to inhibit the circular muscle fibres producing complete relaxation of the outlet of the uterus, and through its communications with the utero vaginal plexus relaxation of the vaginal walls and the composite tissues of the vulva and perineum

It is obvious that the outlet of the uterus should be entirely free from tension and resistance, if the longitudinal muscle fibres are to do their work easily. But we find, however, that the physiological effect of fear is to stimulate the sympathetic nervous system

(3) Fear is a protective instinct, and brings into play every possible means of protecting the individual against harm. It stimulates the activities of flight or combat, and the peculiar appearance that fear produces throughout nature is due to the stimulation of the sympathetic nervous system. This is well seen in a person afflicted by exophthalmic goitre—the staring eye, pale face, perspiring skin, tremors of the hands and knees or even the whole body, rapid pulse, shallow respiration—all combining to give the picture of profound tension of mind and body.

Apply this to the uterus, and we find the same story of tension. A woman in a state of fear, with her sympathetic nerves overriding the normal inhibition of the sacral autonomic, retains the circular muscle fibres of the lower uterine segment and cervix in a condition of relative tension, so that the longitudinal fibres have to expel the contents of the uterus through an outlet that is unwilling to relax. They have to contract against resistance and the dilatation of the cervix uteri requires a far greater muscular force than is necessary in the primitive woman without this disturbance in the neuro muscular harmony of the function.

This can be shown by a trigonometrical equation¹. A small increase in the cervical tension demands a relatively enormous increase in expulsive force in order to obtain dilatation.

Fear, therefore, produces tension, tension pain and pain increased fear. And so the vicious circle of prolonged and difficult labour is complete. So resistant may be the cervix to dilatation that it is actually ruptured or lacerated internally by the force necessary to evacuate the uterus.

All attendants upon labour must recognise the fact that a tense

¹ Natural Childbirth. Dick Read. Heinemann 1933

woman means a tense cervix and a tense cervix means a prolonged painful and difficult labour. A tense woman is a woman who is suffering from nervous tension consequent upon an acute exacerbation of fear.

The Results of Fear

The results of this struggle between the longitudinal and the circular muscle fibres of the uterus owing to the disruption of harmony in the neuro muscular mechanism of labour are far reaching —

(a) During the first stage dilatation of the cervix is slow the uterine contractions are painful the woman suffers all the agony of increasing apprehension which is represented physically by her increased sensitivity to stimulus. A simple painless contraction of the uterus when the woman is in a state of mental tension will produce all the reactions of an agonising experience. Under these circumstances quite extraneous stimuli will give rise to pain such as a sudden noise an ill chosen phrase a veiled insinuation or even a misplaced effort to comfort for in the whole of nature there is no more highly sensitised receptor of painful or frightening stimuli than the mind of the woman in labour.

Her apprehension may make her suspicious of the most harmless activities about her. A white gown a face mask or rubber gloves have terrified more women than is usually suspected. The casual conversation of those about her in terms with which she is not familiar initiates wildest flights of the imagination and the surgical appearance of a labour ward brings to many uninstructed minds the belief that all this would be unnecessary if there were not something wrong.

Apprehension is increased pain and tension follow in its wake. So the first stage can be the cause of innumerable complications.

(b) During the second stage although the tense cervix may have been torn—(those big bilateral tears that we so often see rarely if ever occur in a relaxed labour)—there is still the outlet to contend with.

At the very earliest onset of a contraction the anus is retracted the muscles of the outlet are contracted to resist what is about to occur. This tension makes it practically impossible in a primipara to give birth to the head and shoulders without some laceration of the perineum and often of the posterior vaginal wall. It is the fact of resistance that occasions this laceration.

and it must be remembered that unless anæsthesia is carried to a depth much greater than usually occurs during labour, the sub-conscious influence of fear upon the sympathetic nervous system is not removed. Light anæsthesia does not bring relaxation, if the subject is anæsthetised in a state of fear.

(c) During the third stage of labour we have the obvious result. The placenta, partially separated, may be prevented by a relatively tense lower uterine segment and cervix from being expelled and thereby completely separated. A placenta half expelled into the vagina is often the one that bleeds, and it is owing to the fact that the outlet, still sensitive to the sympathetic stimuli, will close sufficiently to prevent the normal expulsion into the vagina.

Thus, the third stage may cause anxiety and delay. Post-partum hæmorrhage may come from three results of this type of labour —

(i) When the longitudinal muscle fibres of the uterus are worn out, tired, and unable to contract owing to the enormously increased work demanded of them during the first stage of labour.

(ii) The cervix, from which post partum hæmorrhage so often occurs, may be burst open by the final irresistible efforts of the uterus to expel its contents through the tense outlet.

(iii) As is mentioned above by the partial or complete retention of the placenta, and by the incomplete separation of that organ from its uterine site.

The Effects of Tension upon the Birth Canal

In the absence of what may be called normal relaxation of the outlet, the resistance of tissues gives rise to injury throughout the birth canal, injuries to the vaginal wall—stretching straining and laceration of the floor of the pelvis resulting in cystoceles, rectoceles, prolapse and general flaccidity of the pelvic structure. Lower down we get tearing of the perineum and all the variety of consequences.

The question therefore must arise—How can this abnormal feature of cultured labour be eliminated? How can fear be recognised, and what is the proper attitude of the attendant towards the patient in order that the effect of fear should be minimised?

Upon this matter it can be said from the outset that there is no more important feature in antenatal work than the education of the mother in the facts of natural childbirth.

Women in the early months are very difficult to persuade and by simply talking to them it is practically impossible to convey the full truth of this teaching. They have heard too much, they have been told too much and they believe too much. The terrors of labour have to a greater or less degree already taken an important position in their minds. The fact of being pregnant brings them into much closer touch with realities and they are more ready to accept the promptings of their fear than the incomprehensible comfortings of a doctor, or a nurse who has never had a baby.

To endeavour, therefore to combat fear by persuasion in the early months of pregnancy is to court failure in the large majority of cases. Not infrequently about the fifth or sixth month—particularly about the nineteenth or twentieth week when the young mother feels the thrill of the quickening of her baby—the apprehensive phase is distinctly lessened and this is the opportunity to work for the destruction and elimination of her fears. Her child has by then become a recognisable entity and Nature with all her sweet guile, starts to frame the pictures of possibility, and create active maternal anticipation.

Also at this time rest as well as exercise is advised. Here is the opportunity for progressive relaxation¹ to be taught, and from this time forward with practice and care, both doctor and nurse can eliminate fear from the patient's mind. For, by the end of pregnancy the attendant has gained the confidence of the patient by the quiet assurance and restfulness that the teaching has brought.

Confidence, or perhaps better faith is the arch enemy of fear, the two cannot exist at the same time in one mind and there is no better way of obtaining faith than by the teaching of progressive relaxation during the last three or four months of pregnancy.

Method of Instruction in Relaxation

It is easy to teach a woman at this time how to relax. She should be placed either on her bed or in an armchair high enough to allow her to rest her head without having to support it.

Commence by obtaining complete relaxation of the arms. This is extremely difficult at first for muscles are brought into play immediately the arms are touched. If the hand is relaxed and falling over the arm of the chair muscular effort will either resist its being moved or prevent it from falling when lifted.

¹ Progressive Relaxation E. Jacobson University of Chicago Press 1929

After a time, however, complete absence of muscle influence can be obtained by gently lifting the hand and allowing it to fall. Each finger should be tried—no sign of muscular contraction should be allowed. The forearm should then be tested for its relaxation, and the arm raised and lowered without any feeling of resistance or assistance in either movement. If a suitable position has been obtained in the chair or on the bed, the condition of the muscles of the shoulder girdle can then be tested in the same way, and by speaking quietly complete relaxation can be obtained.

The patient becomes conscious of an entirely new sensation in her limbs. She should be invited to extend the hand upon the forearm. The movement should be made as slowly as possible, and with the instructor's fingers upon the forearm the earliest contractions of the muscles can be appreciated, then she should immediately be told to relax the limb again. This should be done several times, and after each period of complete relaxation, a little more power used. Finally, she should be asked to support her own hand for a few seconds. She will then recognise the weight of her hand and the force necessary to suspend it in a position of partial extension.

In this way the patient quickly becomes muscle conscious—and it is not infrequent to find that the arm feels so heavy that it is only raised with difficulty. When this can be demonstrated, it brings with it a sense of confidence in the teacher. It should be applied to the face, the legs, and the whole trunk. Many pass from relaxation into a quiet sleep which is unattended by dreams or any of the disturbing subconscious apprehensions which have caused a tired awakening during the previous months.

The muscular rest occasioned by relaxation is greater than that of sleep. But what is more important than physical rest is that muscular relaxation is accompanied by relaxation of the mind. Fear is a state of neuro muscular hypertension. A state of peace and calm confidence is that of neuro muscular relaxation, and conversely muscular relaxation is impossible under the influence of fear. Thus by the perfecting of the practice of neuro muscular relaxation the influence of fear is eliminated.

We do not tell our patients that we are really treating fear, because even at this stage of pregnancy the suggestion of fear may awaken some resentment in the mind of a woman whose determination to be brave has become a guiding principle.

We teach her relaxation in the knowledge that we are thereby

waging war upon the greatest of all her enemies and that if we are successful in this, we can call upon her to pass into a state of complete relaxation immediately the contractions of her uterus start to re-awaken within her a sense of apprehension

Women of all classes are very susceptible to this treatment if quietly and confidently handled. I have never known a normal case of labour with a prolonged first stage when the practice of relaxation has been efficiently carried out. But, on the other hand it is not unusual for those obstetricians who practise this method having hurried at the first call to find a calm and quiet patient who has suffered little or no inconvenience being attended by an efficient nurse who was not a little agitated to discover the membranes appearing at the vulva before she was conscious that the first stage had been really completed

These are the cases which demonstrate the truth of the aphorism—tense mind tense cervix. They demonstrate the converse—relaxed mind relaxed outlet for with a relaxed outlet so much less is required of the uterus to perform its work. In these cases the elasticity of the vagina and the vulva and perineum make tears and lacerations rare occurrences

And further this method allows of the birth of the child without any deep anæsthesia, in fact in the majority of cases the woman herself will prefer to go on fully conscious so that she may appreciate the mysteries of natural childbirth

The Mental Outlook of the Midwife

Those who attend must look to their own mental attitude. A good obstetrician or midwife must be imbued primarily with a sense of humility and service, loud bombastic fussing busybodies who feel that they are of no service unless they interfere are a danger to the profession. Those who are stimulated by pride to make demonstration of their prowess or to relate histories of difficulties overcome by superlative skill are sowing seeds of destruction for no woman can conduct her own labour peacefully if she is introduced to the possibilities of danger

Obstetricians and midwives must be philosophers and quietly and unostentatiously they should introduce to their patients the philosophy of confidence and peace in the greatest of all natural functions. They must be possessed of an obvious humility, and represent their presence in terms of comfort and instruction, rather than in terms of assistance and interference. Women

properly instructed take a great pride in conducting their own labours, and the reward of the obstetrician is an easy labour, for that is not infrequently the result of the highest skill

It is sound judgment to look askance upon those who too often use forceps. It is a termination of labour which more often results from impatience or ignorance than from skill in performing what is afterwards described as an operation upon an extremely difficult case

The obstetrician should not seek recognition or praise for the dexterity with which he has interfered, but rather find his own reward in the uninjured birth canal, the unmarked baby, the rapidly expelled placenta, the small loss of blood, the absence of shock, the hard, unrelaxing uterus at the end of the third stage, and—which is greatest of all—the indescribable expression of joy and wonder that transfigures the face of the conscious woman as she hears the first cry of her baby

This should be the object of treatment from the first moment that a woman places herself in the care of an obstetrician or a midwife. Antenatal methods to eliminate abnormality should be kept in the background and merely referred to as necessary investigations for the purpose of assuring her that all is as Nature intended it to be. She should be protected from knowledge of complications, and her mind should not be infiltrated with questions of abnormal urine, minor contractions of the pelvis, the unsatisfactory lie of the child, and so on. These observations must be made quietly, and the necessary corrective applied with the object of eliminating fear from her mind, and any treatment should be carried out to the end that her child may be a perfect child even as she is equipped to be a perfect mother

The emotional influences of labour are profoundly important, and in antenatal care women must receive guidance, teaching and education by those of sound philosophical persuasions as well as by those with technical and academic skill

The Care and Control of the Emotions during Labour

When a woman who has been trained in the art of relaxation commences to have her baby, there are certain things to be observed which will enable the attendant to help her to retain that control of her emotions which is essential for an easy and successful confinement.

Unless the process begins in some obvious way, such as the

rupture of the membranes before contractions commence, the woman is interested in the sensations which she feels as the first real expulsive contractions of the uterus develop

She will have been instructed what to expect—a tightening in the abdomen and a sensation of pressure which travels down to the groins or into the back or sometimes around the navel. These sensations are often so faint at first that she is in doubt as to whether it is the real thing or whether it is discomfort from some other cause. Then the regularity of their occurrence at relatively long intervals finally decides the issue, and after a time she will probably feel them in the back and lower abdomen

Now this reaction to the fact of labour creates in the mind a considerable conflict of ideas. Normally, a sensation of pleasing excitement and exhilaration overrules all other emotions but it is not unusual for a very definite feeling of apprehension to creep in

These first few contractions are important, for if she decides that this new sensation is a pain, and if she reacts to it by becoming afraid and therefore tightening up the muscles of the abdomen or holding rigidly with her arms to a mantelpiece or the end of the bed it is going to be very difficult to retranslate the idea of pain into the idea of new sensation

If a woman can lie in a state of complete relaxation confidently realising that she cannot influence the machinery within her that has automatically commenced to work, she can be taught in a few minutes to disassociate herself from that which is going on within her. When it is explained to her that she can do no good by being concerned with these contractions but that it is possible to do a good deal of harm and cause pain by endeavouring in any way to alter their course, she will make every effort to control her impulses and to lie in a state of complete relaxation

Although it is considered by a good many observers unnecessary for a primipara—or in fact for any woman—to lie down during the first stage of labour, it has been found that relaxation is more easily acquired when lying down and therefore dilatation of the cervix much more rapidly accomplished

If it is possible for a doctor to be with a woman at the earliest stage of her labour for a sufficiently long time to be sure he has taught her the whole meaning of the phenomena she is experiencing, he will be rendering to her a service which is probably greater than anything he can do during the rest of her labour

After a time when the contractions become stronger doubts

and fears will again assail the mind of the average girl. Some fresh situation of sensibility, or even—at quite an early stage—disappointment that there is no result after what already seems to have been a very long time, requires explanation.

It is half-way through the first stage that women lose control. They become tense and the contractions therefore become painful. As the uterus rhythmically comes into action it is easy for them to persuade themselves that something must be wrong—not because there is any evidence that all is not well, but because they do not know what to expect; and in the absence of anyone whom they can ask or in whom they can confide these doubts, they will become filled with wild apprehensions and terrifying fears. At this stage tension and therefore pain are the physical reactions to her emotional state.

It is of considerable help in obtaining relaxation to tell the woman to open her mouth a little, and to open her eyes, and preferably to look at something or someone in the room. It is not difficult to relax the arms and legs, but it is very difficult to obtain facial relaxation during the first stage. But relaxation of the face is probably the most important of all, for if that is acquired the attendant may be assured that the mind is relatively at rest.

Regular breathing during the first stage contractions should be aimed at, without any noise, no groan or moan or exclamation should be allowed, for nothing excites tension more than hearing sounds that might indicate pain. Once a woman is allowed to start to groan during her first-stage contractions it will be very difficult to stop her, and as the cervix dilates her resistance will increase and the crescendo of her groans will develop into shrieks. Teach control, and insist quietly but firmly upon the absence of any demonstration. Not infrequently women will roll their heads from side to side, beat violently with their hands, turn and twist their shoulders and move their legs up and down. All these movements are evidence of mental tension. This is represented physically by the initiation of instinctive "escape reactions" to fear. These reactions are conveyed to the muscular system by cortico-thalamic paths; the sympathetic system overcomes the autonomic, and in the machinery of parturition the circular uterine fibres receive motor impulses and contract when they should be relaxed.

Control during this period of the first stage is relatively easy

compared with the effort that may be required to help a woman to relax and use self control during the last two fifths dilatation of the cervix. It is then that the slightest tension appears to give rise to a very definite pain situated in the region of the sacroiliac joints—a pain which can be materially relieved by a firm pressure of the palm of the hand or the wrist where it is felt. That pain has frequently been observed to disappear when quiet and relaxation have been restored.

The final stages of dilatation of the cervix require great fortitude, perseverance and patience on the part of the woman. The presence of the doctor—or a nurse who has been instructed in the details of this procedure—is of the most valuable help to her, particularly in the first labour.

the uterus contracts Nature asserts herself at this point. The extraneous muscles of expulsion are irresistibly brought into play—her abdominal muscles contract whether she tries to relax them or not. We may invite her once this stage is obviously diagnosed to help each contraction by pushing down herself by closing her throat—having taken a deep breath—and not violently but honestly adding pressure by her efforts. This can be done and at the same time it is explained to her that she must open the door, as it were. She must be told that everything is now in readiness for the last part of her labour. Many women find great help in the explanation of the necessity of their baby passing through the door of their body which has been made during the last few hours soft and elastic to allow of the free passage of the child providing that she does not resist the opening of this door herself. She will understand if it is explained to her that she must not squeeze up—she must rather allow the whole of the bottom of her body to relax and be ready to allow the baby to pass through.

Again it is physiologically possible to have considerable tension of the muscles of expulsion and at the same time complete relaxation of the muscles inhibiting expulsion. This is the law in fact in the emptying of any viscus. A sense of great relief is expressed often by women who are allowed to help in these second stage contractions but between them they must be persuaded to relax completely and as the head gets lower in the birth canal and when contractions may come only once in five seven or ten minutes to sleep if possible.

It may be that she will ask for a drink and although cold water is often preferred a few sips of hot infusion of tea or raspberry leaf is a great help in strengthening the contractions. This is a matter of experience, but the writer has patients who would not dream of going through their labour without drinking a certain amount of hot infusion of raspberry leaves. Whether the action is psychical or not is open to investigation.

Then as the anus is gradually lengthened and its anterior wall disclosed as the head comes down and the perineum slowly but surely stretches care must be taken to retain emotional control, to give full explanation and above all the assurance of the normality of the situation. For at this stage a fresh series of sensations is experienced. The slightest effort to resist by closing up the outlet gives rise to the fear that she must split or burst before her baby arrives. When told that there is no fear of that

compared with the effort that may be required to help a woman to relax and use self control during the last two-fifths dilatation of the cervix. It is then that the slightest tension appears to give rise to a very definite pain situated in the region of the sacroiliac joints—a pain which can be materially relieved by a firm pressure of the palm of the hand or the wrist where it is felt. That pain has frequently been observed to disappear when quiet and relaxation have been restored.

The final stages of dilatation of the cervix require great fortitude, perseverance and patience on the part of the woman. The presence of the doctor—or a nurse who has been instructed in the details of this procedure—is of the most valuable help to her particularly in the first labour.

At this time she is most likely to feel real pain because it is at this stage that the smallest mental or physical tension will give rise to pain. Whether it is that the cervix itself is being stretched to its limits and that therefore any additional tension gives rise to actual muscle fibre laceration is a matter of opinion.

It is at this moment that a girl will appeal to be relieved of the whole business—she will imagine that all this strain and turmoil is to no end and that her baby is not coming—that these contractions are useless and that no progress is being made. Just before the full dilatation of the cervix is often the time when she gives up hope when her courage breaks down and when—in a state of almost hysterical disappointment—she will demand to be given something and even go so far as to accuse those who are endeavouring to help her of being heartless and cruel. It is probable that few obstetricians have succeeded in escaping at some time or other these reproaches.

Happily to the majority of women who have been well and carefully instructed the late second stage contractions do not present any insurmountable obstacle and the more completely the art has been acquired the easier it is for a woman to pass through this period of concentrated and sustained effort.

When success is obtained the change that comes over a woman after the full dilatation of the cervix is very marked. The time between the contractions will frequently lengthen considerably and whereas she may have relaxed in a fully conscious state and with an extremely receptive mind when stimulated she will now be almost relaxed between the contractions. There is no

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the uterus contracts Nature asserts herself at this point The extraneous muscles of expulsion are irresistibly brought into play—her abdominal muscles contract whether she tries to relax them or not We may invite her once this stage is obviously diagnosed to help each contraction by pushing down herself by closing her throat—having taken a deep breath—and not violently but honestly adding pressure by her efforts This can be done and at the same time it is explained to her that she must open the door as it were She must be told that everything is now in readiness for the last part of her labour Many women find great help in the explanation of the necessity of their baby passing through the door of their body which has been made during the last few hours soft and elastic to allow of the free passage of the child providing that she does not resist the opening of this door herself She will understand if it is explained to her that she must not squeeze up—she must rather allow the whole of the bottom of her body to relax and be ready to allow the baby to pass through

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if she will remain calm and relaxed the sensation frequently disappears

At this time any woman who has carried out this great work, who has been buoyed up by fortitude and courage sufficient to maintain her mental and physical control is quite justly rewarded by being told by her attendant how splendid her efforts have been in whatever terms are suitable to the class and type of girl who is being waited upon. Justifiable praise and possibly—to the understanding obstetrician—real admiration should not be withheld for it sinks through the natural amnesia of the second stage and produces that little extra something which is almost equivalent to that which the well trained athlete pulls out in the final dash for the tape

Before the head crowns she may ask why it keeps on slipping back or some question concerning that apparently disappointing phenomenon. Finally the head crowns. Here again complete relaxation should be called for, and is usually possible to obtain, in order that the head may be gently guided into the world through soft and relaxed perineal tissue, offering the least possible chance of laceration

Lacerations seem to be extremely common, although many of them are only superficial skin. It has been observed that the birth of the forehead, eyes and nose is completed without any tear very frequently but for some unaccountable reason the chin, shoulder or an elbow will cut like a knife through the perineal tissues

The passage of the head through the vulva is yet another new sensation and in the fully conscious woman may, if she is not completely relaxed cause what is equivalent to a start or a jump which results in a sudden resistant squeeze of all the muscles of the outlet. They are probably so tense at the moment that there is no room for muscular action except by laceration across that structure which at the moment is maintaining the tension

Since this suggestive circumstance was observed women have been warned of the sensation caused by the passage of the child's head, they have been told that it is what they must look for and expect. It has been described as something suddenly giving way or slipping and above all things, they must try their utmost to avoid any action of resistance or squeezing up, and, as the child is felt to be passing the outlet, they must do their best to relax quietly, to cease to make any effort at expulsion and to maintain

the elasticity and freedom of its passage. A definite improvement in the number of lacerations has been noticed since this explanation has been made to the conscious mother.

How great is the reward of the obstetrician for the patience and effort resulting in the retention of emotional control by a mother in childbirth! When finally she hears her baby cry it is as though she awakens from a dream—her realisation of a fact which seems to be almost incomprehensible—no longer in an amnesic state, no longer tired. In a moment that cry awakens the spirit of motherhood. There is no sentimentality in the frank statement that it is a picture of supreme beauty and every obstetrician should not only recognise the delights of that moment but should encourage its appreciation by the mother herself. The cry of the child, the warmth of its moving limbs that she may feel the fact of life, are realities which make in a few seconds the whole character of a woman. There is no need to cover the child hastily in a towel, to whisk it away immediately the cord is severed and hide it in a cradle. Treat its eyes and wipe its face and wrap it in a blanket. There is no fear of shocking a mother by the sight of her own baby. Show it to her and if you think it is a risk listen to her remarks —

“Is it a boy or girl? Is it absolutely perfect? Are you sure it is all right? Do let me see it!”

There is very little variation in what a woman has to say at that moment. Get into her mind, share with her this full accomplishment. Your third stage will be easy. She will be fit and well and will have almost forgotten after a few hours—and certainly after her first sleep—the stupendous effort that was required of her to accomplish this thing.

The whole training of the emotional attitude from conception to the end of the second stage may be wasted if the joy of completion is not allowed to be appreciated and the reward of a magnificent effort justifiably recognised. Are we not too matter of fact? Do we not overlook how momentous this miracle is to the mind of a woman? This picture is not overdrawn. There are obstetricians to day who have patients who would not dream of having an anæsthetic or drug that would prevent a repetition of this great happiness.

“I have a sweet child of three, but I have not known before how marvellous it is to have a baby.” Her first child had been brought into the world under deep anæsthesia with a forceps delivery.

Not long ago a girl in the early twenties whose first baby had been born under the influence of relaxation asked if as her second child was about to arrive 'Would it be a terrible thing to let my husband come and watch our child being born?' Such an unusual request was met by a few moments' thought, and she added 'It is his child.' Her child was born whilst she herself held her husband's hand and when it cried she laughed at the expression of amazement on his face and almost before the feet had left her she said 'I told you it was the most marvellous thing in the world.'

Obstetricians must ask themselves if they are justified in denying the women of our time the perfection of this emotional reaction which is a bond between mother and child which is a bond to keep together husbands, wives and families, and it is strongly suggested that emotional perfection should be placed in a much higher category of importance than that of mere physical adequacy.

It will be clear that the conduct of labour should always be in an atmosphere of peace and quietness. Disturbing noises should be avoided—the opening and closing of doors, people coming in and going out, and conversation between those in the room should be discouraged. Although it is not always easy to obtain quiet from the rush and hurry of life in the street below, so far as possible noise should be eliminated. The perfect labour is conducted in a silence which is only broken from time to time by such conversation as may be of relief or assistance to the woman. She is interested in nothing else in the world but the immediate present and if properly educated in relaxation her concentration will be required to that end. The guarded remarks of those about her touched with firm sympathy but inspired by gentleness and kindness is the foundation upon which the receptive mind of a woman at this time is most likely to build confidence.

It is not a time for stories, neither is it a time for loud laughter and false cheerfulness. Peace is the only atmosphere which is conducive to relaxation. By the time the second stage of labour is reached absolute quiet should obtain. The woman will be sensible to the strength and efficiency of those who understand her own instinctive demands.

There are few moments in an obstetrician's work which are more impressive than those silent, restful pauses between the strong, prolonged expulsive contractions that drive the head down to the outlet. The quickened respiration that follows the muscular

effort, the flush of congestion that results from the physical strain, the rest that rebuilds determination to make the best use of the next contraction are indications of the fundamental courage and perseverance with which Nature has endowed her healthy minded women

During the age of anæsthetics much of the clinical importance of these observations has been overlooked. Second stage contractions in a natural labour are without any physical pain, but they are definitely attended by physical strain. Anæsthetics have been used in an effort to reduce physical strain because it has been misunderstood by clinicians. Over 100 years ago Dr William P Dewees¹ observed —

‘ That man is of little use to the exercise of the social virtues who is ignorant of the influence a kind and feeling conduct has upon his suffering patient. To her it almost atones for the want of skill and experience and to deprive her of it is withholding a right for which nothing beside can compensate

A little later he says —

“ Her mind should be kept as free from anxiety as the nature of her situation would permit for no conversation should be indulged in that might for an instant excite her apprehensions

Again he says referring to conversation —

• “ and should be as void of levity as of gloom

Two further remarks in the same chapter are of interest —

“ The patient is to be forbidden everything which shall have a tendency to excite the system. And ‘ She should be directed to keep as quiet as possible ’

It is not without interest that as a result of investigation into the emotional influences upon labour conclusions were arrived at which were later found to have been deduced by the experience and observation of clinicians before the days of detailed scientific psychological study or anæsthesia

¹ ‘ Compendious System of Midwifery London 1825

CHAPTER VI

CONSTRUCTIVE, EDUCATIONAL AND SOCIAL ASPECTS OF ANTENATAL CARE

By JOHN S. FAIRBAIRN, B.M., B.Ch., F.R.C.P., F.R.C.S.,
F.R.C.O.G.

THE purpose of this chapter is to offer a brief survey of an area of antenatal care complementary to the obstetrical and medical regions forming the main subject matter of the book. Constructive hygiene though predominantly medical, is closely linked with the educational side and as border line territory, cannot be entirely omitted from a wide outlook over all the activities comprised in antenatal care. A survey of this kind, however, must be preceded by a glance further afield if the position and objectives of the maternity services are to be seen in due perspective in their setting among other closely related services of which they form an important part.

Owing to its concern with the start of a new generation, midwifery holds a key position in all efforts to promote national health and physique. Its part is to secure the maximum new lives at the minimum cost in loss of or damage to the mothers, and to give a fair start to these new lives. A series of services should be visualised of which prenatal care may be regarded as the first, and followed in turn by intranatal management and postnatal care to ensure the efficiency of the mother on return to her duties. The follow up of mother and infant in the welfare clinics has the objective of promoting normal development through the early years when growth is most active and liability to stunting of body and mind greatest. Conducted thus through the first five years of life the child next passes under the school nurse and medical officer, and when adolescence is reached falls from then onwards under the observation of practitioners working under the National Health Insurance Acts. When the present widespread call for physical education and training for the youth of the country is translated into legislation or otherwise made generally available, there will be a practically continuous supervision of each generation—from the parents of one to those of the next. The cycle for its completion will require prenuptial or preconceptional clinics

CHAPTER VI

CONSTRUCTIVE EDUCATIONAL AND SOCIAL ASPECTS OF ANTENATAL CARE

By JOHN S FAIRBAIRN, B.M. B.Ch. F.R.C.P. F.R.C.S.,
F.R.C.O.G.

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SOCIAL ASPECTS OF ANTENATAL CARE

clinics or a medical practitioner for at least two medical examinations, one as soon after the patient has booked as possible, and the other about a month or so before the expected date of delivery, but are not all prepared to pay the doctor's fee. The rule of the C.M.B. is that the midwife should call to her assistance when necessary for illness or abnormality during child-bearing the practitioner of the patient's choice. Generally the rule would result in the same practitioner being consulted throughout unless the antenatal care had been conducted at a public clinic. In the case of her own booked patients the Rules say that the midwife must make an antenatal examination at the earliest possible opportunity, see her patient during pregnancy as often as is necessary, and keep notes of her observations on the record-card approved by the Board, on which there is also space for notes by a medical practitioner. The Rules also place the obligation on the midwife of urging the patient to seek advice from her medical attendant, or at a hospital or similar institution, whenever abnormality has occurred in a previous pregnancy, also in all cases of illness or abnormality during pregnancy. Except in the last no obligation is placed on her to send a medical aid form. Among the leaflets bound up with the Rules as issued to midwives is one on antenatal care in which she is again urged to advise her patients to obtain the two medical examinations mentioned above. The instruction is also given that the midwife should obtain the name of the patient's doctor at the time of booking, as he will naturally be the one to be called in for illness or abnormality. It is also explained that if a medical investigation is made of the normal pregnant woman or because of abnormality in a previous pregnancy, the midwife cannot fill up the form of sending for medical aid, as the case is not one of emergency, nor need she inform the local supervising authority. The reason for this differentiation is that there is no provision under the Midwives' Act for the payment of medical fees except for what are known as "emergencies under the Act," of which the official explanation is that it must be illness or abnormality within the meaning of the relative rule. The midwife is, however, told to consult her inspector in the case of patients unable to pay a medical fee, or unwilling to attend a clinic, as many supervising authorities have local schemes by which fees are paid for antenatal medical examinations. As co-operation between medical practitioner and midwife is essential to the efficiency of the maternity services and as misunderstand

ings often arise regarding the position of the doctor in midwives' cases, this explanation is given in so far as the Midwives' Acts, the Rules of the C M B and the responsibilities of local health authorities are concerned. Under the Midwives' Act of 1936 and the new training regulations of the C M B, changes in practice are certain, but until the Act has been operative for a few years only speculations can be made on the direction they might take.

In concluding a partial survey of the less obvious aspects of ante and post natal care, the main points intended to be emphasised may be summarised thus —

(1) The ultimate purpose should be kept in mind if the prominence of education in mothercraft, and other social features, are to receive adequate attention.

(2) Antenatal care cannot be carried out in its full integration without a just combination of all it implies.

(3) Hospitals, clinics and practitioners providing prematernity services must therefore include all aspects in due proportion to conform with present day requirements.

CHAPTER VII

HEREDITY

Our inheritance is a mosaic of ancestral contributions. The manner in which these contributions are made, their extent, their relations to each other, the laws which govern them, and the bearing of these laws on human heredity are problems of great interest and importance to all engaged in antenatal care.

As a preliminary to a study of the subject, let us first of all call to mind some elementary considerations.

Maturation of the Germ Cells and Fertilization

Consideration of the complicated series of events accompanying maturation of the germ cells would occupy too much space and is in any case not essential for our purpose. It is sufficient to recall that the end result achieved by maturation (meiotic or reduction division) is the reduction of the chromosomes in the germ cell to half their original number. Before maturation begins the germ cell contains the same number of chromosomes as the somatic cells—the number characteristic of the species. These are in pairs, one of each pair having been derived from the female and the other from the male parent at the time of fertilization. In maturation, one of each pair of chromosomes is cast out in the first polar body. The chromosomes thus rejected may be either the male or female one of the pair—it seems to be a matter of chance. This obviously affords opportunity for large numbers of permutations and combinations amongst those chromosomes that are retained. There is thus little chance that any two matured germ cells (gametes) even from the same ovary will retain exactly the same assortment of chromosomes.

At fertilization the ovum, now containing one half its original number of chromosomes, combines with the male element (sperm) in which, by maturation, the number of chromosomes has also been reduced to half by a process similar to that which has occurred in the female germ cell. The result is that the fertilized germ cells (zygotes) all contain the number of chromosomes characteristic of the species (48 in man), half of which have been derived from the female and half from the male. The chromosomes in the zygote arrange themselves in pairs so that of each pair one has

come from the female and one from the male partner. In the subsequent division of the fertilized cell during development of the body of the embryo (mitotic division) each chromosome splits longitudinally into two halves, one of which goes to each of the two daughter cells. Each somatic or body cell therefore contains the same number of chromosomes as the original germ cell before maturation or after fertilization, i.e., the number characteristic of the species. It is believed that the chromosomes are the bearers of the hereditary characters, half of which are therefore derived from the male and half from the female partner. Half of the hereditary characters of each parent (half the chromosomes) have been in turn derived from their parents and so on backwards for as long as the species existed.

The Chromosomes as Bearers of Hereditary Characters

According to modern conceptions the chromosomes which we have previously seen are arranged in pairs, one of each pair having been derived from the male and one from the female partner are the bearers of the hereditary unit characters or genes. The genes are arranged longitudinally like beads on a string each occupying a definite and constant position (locus) on the chromosome. The pairs of genes lying opposite each other, that is, occupying corresponding loci on the chromosomes, are known as allelomorphs. Each allelomorphic pair governs or determines the same character, and may be identical, e.g., both "black" determining (homozygous) or contrasted e.g., one "black" determining and the other "white" determining (heterozygous). Each chromosome contains large numbers of such genes.

Mendelism Without doubt the greatest contribution to our knowledge of heredity was made by the monk, Gregor Johannes Mendel (1822-1884), abbot of the monastery at Brunn (Brno) in Moravia. His papers, containing the results of his experiments in the garden of the monastery, were published in the Proceedings of the Natural History Society of Brunn, but their importance was not recognised until they were rediscovered sixteen years after his death. His work is so fundamental that it has served as a basis for all subsequent investigations on the subject—investigations that have only served to confirm and amplify his conclusions.

Mendel showed that the transmission of hereditary characters was not a matter of chance but took place according to certain well-defined laws. His experiments were carried out on varieties

of the ordinary edible pea, which he had observed to breed true, i.e., have the same characters when self fertilized—the normal occurrence, through several generations. He chose fourteen varieties which could be arranged in pairs in each of which one member differed from its fellow in one well-defined pair of characters. The following table gives the characters in which members of the seven pairs differed —

<i>Characters of one variety</i>	<i>Characters of contrasted variety</i>
(1) Ripe seeds round and smooth	Ripe seeds wrinkled
(2) Cotyledons contained yellow albumin	Cotyledons had green albumin
(3) Seed coats coloured	Seed coats white
(4) Pods smooth	Pods constricted
(5) Unripe pods green	Unripe pods yellow
(6) Flowers axil	Flowers terminal
(7) Stems tall	Stems dwarf

Mendel now made crosses between peas having contrasted characters studying one pair of such characters at a time. Thus he crossed peas whose seeds were round and smooth with peas whose seeds were wrinkled, peas whose cotyledons had yellow albumin with peas having green albumin, etc., till all the seven pairs of characters were examined. Now it was found that the cross bred or hybrid offspring (which we shall call the first filial generation, or F1) all resembled one of their parents. Thus the hybrid resulting from the crossing of the first pair of characters in the above table were all round and smooth, those resulting from the crossing of the second pair all had yellow albumin, etc. In other words one of the contrasted characters had been suppressed or receded from view and was therefore named by Mendel a "recessive." The other character which dominated the picture he called a "dominant." The complete series of crossings resulted in all the dominants and recessives being sorted out, and it was then found that the characters in the first column of the above table were dominant and those in the second recessive. If we call the parents R and r the first filial generation (F1) are hybrids Rr.

When now these hybrids were grown and allowed to self fertilize it was found that their progeny (second filial generation F2) were not all alike but had sorted themselves out so that three were like their dominant grandparent, and one like their recessive grandparent. Thus if the original crossing had been between two seeds one of which was round and the other wrinkled

3 out of every 4 peas of the F_2 generation were round and 1 was wrinkled. This can be made clear in the following way. Let us suppose that R represents the hereditary unit character of roundness and r the contrasted character of wrinkledness. In the first crossing R was crossed with r thus

$$R \times r = Rr$$

Rr is a hybrid in which R is dominant and r recessive. The hybrid is, of course, round, as roundness is dominant. The character r is not lost, however, it has simply receded from view. Farther, it has not merged in or blended with R but has maintained its identity as is shown by the crossing between any two of the hybrids, or (what is the same thing) by self fertilizing any one of them. This is shown in the following formula which represents what happens in the crossing of the hybrids —

$$Rr \times Rr$$

Let us suppose that the unit characters in this formula unite with one another according to the laws of chance (which they actually do) the results will be as follows —

R may unite with R giving RR a pure dominant, round
 R may unite with r giving Rr an impure dominant, round
 r may unite with R giving rR an impure dominant, round
 r may unite with r giving rr a pure recessive wrinkled

The results of the crossing between the hybrids Rr will therefore be —

RR	Rr	rR	rr
Round	Round	Round	Wrinkled

RR is round, is called a pure or "homozygous" dominant, as it has the dominant character of roundness in both its genes. It also will always, if crossed with itself (self fertilized), breed true, i.e., produce only RR (round) peas. rr is wrinkled, is a pure or homozygous recessive, as it has the recessive character of wrinkledness in both its genes. It will always, if crossed with itself (self-fertilized), breed true, i.e., produce only rr (wrinkled) peas.

Rr and rR are hybrids and are of course round. They are impure, or "heterozygous," as they contain genes for both roundness and wrinkledness. If crossed with each other or self fertilized they will always behave as in the formula above, namely, produce peas 3 of which are round and 1 wrinkled.

It will therefore be clear that the result of intercrossing the hybrids has been that the characters in the hybrids have become re sorted so that there is 1 pure dominant (round), 2 hybrids (round) and 1 pure recessive (wrinkled). This is the well known 1 2 1 Mendelian ratio for a cross between two hybrids where one unit of character is involved. It will be seen therefore that the results of interbreeding between the hybrids where one pair of contrasted unit characters is involved is a progeny in which—

(a) Three out of every four are externally like one of the grandparents and one like the other

(b) The dominants are to the recessives as 3 to 1

(c) Only one of the dominants breeds true, and the recessive breeds true

(d) The other two dominants are hybrids

If now peas having two pairs of contrasted unit characters are crossed for example one having round coat and yellow albumin (both dominant) with another having wrinkled coat and green albumin (both recessive), all the hybrid offspring will have round coat and yellow albumin. Each hybrid however, also contains the characters wrinkled and green. If now these hybrids are self fertilized or crossed with one another the resulting offspring will be in the following proportions—

Round coat	Round coat	Wrinkled coat	Wrinkled coat
Yellow albumin	Green albumin.	Yellow albumin.	Green albumin.
9	3	3	1

and each group includes one pure breeder

The proportion 9 3 3 1 is the normal Mendelian ratio for a cross between hybrids where two pairs of unit characters are involved. What occurs in the mating of these hybrids may be represented as follows. Again if R represent roundness, r wrinkledness, Y yellow colour, and y green, the hybrid resulting from the crossing between the pea with round coat and yellow albumin on the one hand (RY) and one having wrinkled coat and green albumin (ry) is $\frac{Rr}{Yy}$

If now this hybrid is crossed with a similar one or is self fertilized the following combination takes place—

$$\frac{Rr}{Yy} \times \frac{Rr}{Yy}$$

Let us study each of the pairs of contrasted characters separately and

$Rr \times Rr$ gives RR Rr Rr rr

and $Yy \times Yy$ gives YY Yy Yy yy

but as each shape combination can combine with each colour combination the following represent the possible progeny —

$\begin{array}{ c c } \hline RR \\ \hline YY \\ \hline \end{array}$	$\begin{array}{ c } \hline RR \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline RR \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c c } \hline RR \\ \hline yy \\ \hline \end{array}$
$\begin{array}{ c } \hline Rr \\ \hline YY \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline yy \\ \hline \end{array}$
$\begin{array}{ c } \hline Rr \\ \hline YY \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline Rr \\ \hline yy \\ \hline \end{array}$
$\begin{array}{ c c } \hline rr \\ \hline YY \\ \hline \end{array}$	$\begin{array}{ c } \hline rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c } \hline rr \\ \hline Yy \\ \hline \end{array}$	$\begin{array}{ c c } \hline rr \\ \hline yy \\ \hline \end{array}$

There are thus sixteen possible combinations four of which (enclosed by squares) are pure breeders. If these combinations are examined and it is borne in mind that round and yellow are dominant, and wrinkled and green recessive, it will be found that the shape and colour combinations are present in the proportions mentioned above namely 9 3 3 1 and that in each group one is a pure breeder (homozygous)

If, in the same way three pairs of contrasted unit characters are crossed, e.g., round coat, yellow albumin, and coloured seed coat with wrinkled coats, green albumin, and white seed coats it might be shown that there will be eight resulting groups in the following proportions —

Seeds	Round	Round	Round	Wrinkled	Round	Wrinkled	Wrinkled	Wrinkled
Albumin	yellow	yellow	green	yellow	green	yellow	green	green
Seed coats	coloured	white	coloured	coloured	white	white	coloured	white
Numbers	2	9	9	9	3	3	3	1

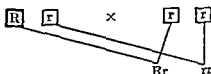
The Mendelian ratio for crosses between hybrids may therefore be stated in general terms thus "If the original parents differ in n pairs of contrasted characters their hybrid progeny consist of 2^n groups, the numbers in which are to each other in the ratio $(3 : 1)^n$ "

Mendel's Law of Segregation of the Gametes Mendel proved experimentally that the sorting out that occurs when hybrids are crossed as explained above (for example in the 1 2 1 ratio) is due to the fact that the hybrids form as many kinds of gametes both male cells and female cells as there are genes involved and in equal numbers. Thus in the hybrids $Rr \times Rr$ two distinct kinds of both male cell and female cell are formed one containing (R) and the other (r) and in equal numbers and when crossed these are free to combine with one another according to the laws of chance. When these two hybrids are crossed thus —

$$\begin{array}{|c|} \hline R \\ \hline r \\ \hline \end{array} \quad \times \quad \begin{array}{|c|} \hline R \\ \hline r \\ \hline \end{array}$$

the chances are equal that $\begin{array}{|c|} \hline R \\ \hline \end{array}$ will combine once with $\begin{array}{|c|} \hline R \\ \hline \end{array}$ giving RR that $\begin{array}{|c|} \hline R \\ \hline \end{array}$ will combine twice with $\begin{array}{|c|} \hline r \\ \hline \end{array}$ giving 2 Rr and that $\begin{array}{|c|} \hline r \\ \hline \end{array}$ will combine once with $\begin{array}{|c|} \hline r \\ \hline \end{array}$ giving rr. This will give the 1 2 1 ratio above described. Similarly the hybrid $RrYy$ forms four kinds of gamete in equal numbers viz $\begin{array}{|c|} \hline R \\ \hline \end{array}$ $\begin{array}{|c|} \hline r \\ \hline \end{array}$ $\begin{array}{|c|} \hline Y \\ \hline \end{array}$ $\begin{array}{|c|} \hline y \\ \hline \end{array}$ and if crossed with itself and the male and female gametes are able to combine freely they will do so in the ratio 9 3 3 1.

Cross between a Hybrid and a Pure Recessive One other ratio very important in human heredity must be discussed i.e. the result of crossing a hybrid with a pure recessive. If for example we cross the hybrid Rr (R standing for the dominant character and r for the recessive) with rr a pure or homozygous recessive the former will form two kinds of gametes viz. $\begin{array}{|c|} \hline R \\ \hline \end{array}$ and $\begin{array}{|c|} \hline r \\ \hline \end{array}$ and the latter only one viz $\begin{array}{|c|} \hline r \\ \hline \end{array}$ and the result of union will be as follows (the disease factor being surrounded by a darker square)



that is two kinds of progeny are formed and in equal numbers so that they will bear to each other a 1 1 ratio which is important in medical prognosis in the following way. Let us suppose that the factor R is one carrying a hereditary disease and the individual carrying it (who of course as the factor is dominant shows the disease) marries another who so far as that disease is concerned

is healthy, then it may be expected that half the children will be healthy (rr) and without the power of transmitting the disease, while the other half (Rr) will show the disease and transmit it in turn to half their children

If, on the other hand the disease factor is recessive (r) and the bearer of it mates with a healthy person the union will be between the hybrid Rr and a pure dominant RR . Rr again forms two kinds of gametes $[R]$ and $[r]$, while RR forms only one, viz, $[R]$

The mating may be shown thus (the disease bearing factor being denoted by a darker square)

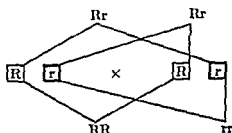


and the result will be RR Rr , that is two kinds of progeny are again formed and in equal numbers, viz in a 1 : 1 ratio. RR is healthy while Rr is also healthy but will again transmit the taint to half his or her children. Therefore, while all the children of such a marriage will be healthy half of them will bear a recessive and transmissible taint.

It should be noted that when a disease or abnormality is recessive it cannot become externally manifest (as a disease or abnormality) unless the factor for it is borne by both genes. This can occur for example if the hybrid Rr above, bearing the recessive disease factor r , mates with one like itself thus

$$Rr \times Rr$$

Here the gametes formed by both male and female are of two kinds $[R]$ and $[r]$ and the result of the union can be shown diagrammatically as follows —



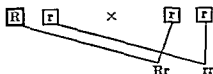
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Mendel's Law of Segregation of the Gametes Mendel proved experimentally that the sorting out that occurs when hybrids are crossed as explained above (for example in the 1 2 1 ratio) is due to the fact that the hybrids form as many kinds of gametes both male cells and female cells, as there are genes involved, and in equal numbers. Thus in the hybrids $Rr \times Rr$, two distinct kinds of both male cell and female cell are formed, one containing (R) and the other (r) and in equal numbers, and when crossed these are free to combine with one another according to the laws of chance. When these two hybrids are crossed thus —

$$\begin{array}{|c|} \hline R \\ \hline r \\ \hline \end{array} \times \begin{array}{|c|} \hline R \\ \hline r \\ \hline \end{array}$$

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Cross between a Hybrid and a Pure Recessive One other ratio very important in human heredity must be discussed, i.e., the result of crossing a hybrid with a pure recessive. If, for example, we cross the hybrid Rr (R standing for the dominant character and r for the recessive) with rr, a pure or homozygous recessive, the former will form two kinds of gametes viz., $\begin{array}{|c|} \hline R \\ \hline r \\ \hline \end{array}$ and $\begin{array}{|c|} \hline r \\ \hline r \\ \hline \end{array}$ and the latter only one viz., $\begin{array}{|c|} \hline r \\ \hline r \\ \hline \end{array}$ and the result of union will be as follows (the disease factor being surrounded by a darker square)



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somes We have seen that the Mendelian ratios above described were only explicable on the supposition that the different unit characters involved were segregated in separate gametes, both male and female, and were able to combine freely with each other in the manner described, for example, in the 1 2 1 ratio Now unless the various genes which he studied, *e g*, roundness, yellow albumin, tallness, etc., had been contained in separate chromosomes these free combinations could not have occurred because the chromosomes cannot disintegrate and liberate their genes All the genes in one chromosome must therefore remain associated, segregate together in the gametes, and be transmitted together This is what is known as "linkage," a phenomenon unknown to Mendel A good example of it is furnished by the fruit fly *Drosophila Melanogaster* which may have red eyes and wings of normal size, or brown eyes and vestigial wings, red being dominant to brown and normal wings to vestigial Now if a fly which has red eyes and normal wings is mated with one having brown eyes and vestigial wings, and the characters are free to segregate separately in the male and female gametes and then to combine freely with each other in the normal Mendelian manner, four combinations should appear in the offspring, namely, red eyes and normal wings, red eyes and vestigial wings, brown eyes and normal wings, and brown eyes and vestigial wings, and these combinations would occur in the ratio 9 3 3 1 respectively It is actually found, however, that by this crossing only two combinations occur, namely, red eyes with normal wings, and brown eyes with vestigial wings, and these appear in equal numbers The explanation is that the genes for red eyes and normal wings are carried in the same chromosome, and therefore cannot separate or segregate and so they stay together in the gametes Similarly their allelomorphs, *viz*, the genes for brown eyes and vestigial wings are contained in the same chromosome and also remain associated in the gametes The fly, therefore, having red eyes and normal wings with the formula $Rr Nn$ forms only two (instead of four) kinds of gametes namely $\begin{bmatrix} R \\ N \end{bmatrix}$ and $\begin{bmatrix} r \\ n \end{bmatrix}$, and the fly having brown eyes and vestigial wings and having the formula $rr nn$ forms only one kind of gamete namely $\begin{bmatrix} r \\ n \end{bmatrix}$ If these two are crossed thus

$$\begin{bmatrix} R \\ N \end{bmatrix} \quad \text{or} \quad \begin{bmatrix} r \\ n \end{bmatrix} \quad \times \quad \begin{bmatrix} r \\ n \end{bmatrix}$$

The mating therefore produces RR , $2Rr$ rr , i.e. the 1 2 1 Mendelian ratio previously described. Of the children therefore

- 1 out of 4 (RR) will be healthy and bear no transmissible taint
- 2 out of 4 (Rr) will be healthy but carry a transmissible taint
- 1 out of 4 (rr) will be diseased and carry a double transmissible taint

This marriage illustrates the danger of inbreeding between two families affected by the same disease and its result should be compared with the much less harmful result of the two marriages above described between one tainted and one healthy parent.

The worst results of all are obtained by the union of two persons each of whom is the victim of a recessive disease, e.g., deaf mutism. Here the union will be between rr and rr and as only (r) gametes are formed by male and female all the children will be rr and therefore diseased and as the disease is recessive they will carry it in both factors

"Blending" or Incomplete Dominance

Since Mendel's time some instances have been discovered in which characters that are usually dominant fail to mask entirely their recessive counterpart. Thus black is usually dominant to white and if a black rabbit of pure strain be mated with a white Angora the resulting hybrid offspring will be all black. If however a black Andalusian fowl is crossed with one that is pure white the hybrids will be of an intermediate colour, viz., 'blue' Andalusian (really grey) much favoured of poultry breeders for their egg laying properties. Here the black has not completely dominated the white and a blend of colour results. No blending of the genes has however, occurred for if the 'blue' hybrids are crossed with each other, black, blue, and white will be produced in the usual Mendelian ratio of 1 2 1 respectively. Incidentally, a practical application of a knowledge of Mendelism is exemplified here for it will be noted that if blue Andalusians are crossed with each other only half the progeny will be blue, whereas if a black and a white are crossed, all the progeny will be the desired blue

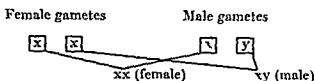
so that the

Linkage

in medicine the factor I (the factor i carrying it) sometimes Mendel made his experiments the modern concept of chromosomes as the bearers of the hereditary characters (disease) marries and it was therefore fortunate that all the contrasted and by him were contained in separate chromo-

chromosomes is normal its fellow is vestigial (Fig. 15). The normal sex chromosome is designated x and the vestigial chromosome y . In the female therefore (in mammals) the sex chromosomes are xx and in the male xy . In humans there are altogether twenty four pairs of chromosomes i.e. forty eight in all in the somatic cells. There are therefore $46 + 1x$ chromosomes in the female and in the male $46 + 1y$.

Now while the x chromosome contains large numbers of sex determining and other genes the y chromosome is empty and inert. This has an important bearing on the inheritance of certain sex linked diseases such as hemophilia to which we shall refer later. It is also important to note that sex is determined by the number of genes in the sex chromosomes rather than by the kind of genes i.e. sex is a matter of quantity rather than quality and we shall see later that the chromosomes whether in the male or female can be shuffled about from one sex to the other. To put it in another way it is not the y chromosome that determines the male sex but rather the fact that the male cell contains only one x chromosome. As the female cell contains only xx sex chromosomes all the gametes formed will contain x . In the male on the other hand all the cells are xy and hence on reduction two kinds of gamete will be formed one having x and the other y and these will be formed in equal numbers. The possible combinations between the female and male gametes (ovum and sperm) will be as follows $\boxed{x} \boxed{x} \times \boxed{x} \boxed{y}$. Now x may combine with x or with y and the chances of its combining with either are equal. Therefore the two possible combinations are xx (female) and xy (male) and these will occur in equal numbers where large numbers of matings are involved. Thus is explained the almost equal incidence of males and females in the population. It will be seen also that in the above mating the x chromosome is shuffled about from male to female and *vice versa*. This is made perfectly clear in the following diagram —



We have seen above that the ratio of males and females born is only approximately equal. There is a slight preponderance of

the chances are equal that $\begin{bmatrix} r \\ n \end{bmatrix}$ will combine with $\begin{bmatrix} R \\ N \end{bmatrix}$ giving $Rr \ Nn$ namely a fly having red eyes and normal wings or with $\begin{bmatrix} r \\ n \end{bmatrix}$ giving $rr \ nn$ namely one with brown eyes and vestigial wings. These two varieties occur therefore in equal numbers or in a 1 : 1 ratio. As a general rule it may be stated that *all the genes in a chromosome remain linked and are transmitted together in inheritance*. The number of chromosomes therefore will be the same as the number of sets of linked genes. Thus in *Drosophila* there are four pairs of chromosomes and the sets of linked genes with their corresponding allelomorphs are also four in number.

Determination of Sex

Sex is a Mendelian character and is determined in accordance with the general laws described above. The sex genes lie mostly in the sex chromosomes which are two in number. We have seen that the autosomes (the other chromosomes not concerned with sex) are paired in the somatic cell, the members of each pair being to outward appearance exactly alike. In one of the sexes (the

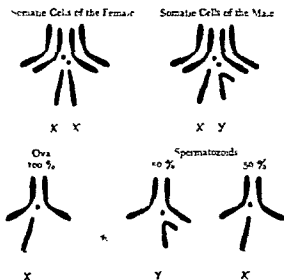


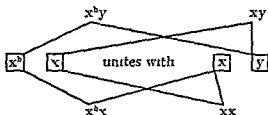
FIG. 10. Chromosome sets in males and females of *Drosophila*. (Baur.)

female in mammals) the sex chromosomes also are exactly alike. In the other however (the male in mammals) while one of the sex

When this female carrier mates with a healthy (non hæmophilic) male $x^h x$ unites with xy . The female forms two kinds of gametes x^h and x whereas the two formed by the male will be x and y . The following combinations therefore between the male and female gametes will all be equally probable —

$x^h x$	$x^h y$	xx	xy
Female non hæmophilic carrier	Male hæmo philic carrier	Female non hæmophilic non carrier	Male non hæmophilic non carrier

How these combinations occurred will be clear from the following diagram —



The result is that

- (1) Half the females are carriers and transmitters of the disease
- (2) Half the females are free from taint and therefore do not transmit
- (3) Half the males are hæmophilic and transmit the disease
- (4) Half the males are healthy, carry no taint and do not transmit the disease

One other explanation is necessary here. We have seen that the hæmophilia gene is recessive. In the female it is therefore masked by its allelomorph the factor for "absence of hæmophilia" which is dominant. The female, therefore, though bearing one tainted gene, is herself healthy. The male on the other hand though also bearing only one tainted gene is hæmophilic. The reason is that the y chromosome is empty as we have already seen, and thus bears no dominant to mask the recessive which therefore becomes manifest, so that the male is hæmophilic.

Can a female ever be herself hæmophilic? This is theoretically possible if a carrier female mates with a hæmophilic male thus —

$x^h x$ mates with $x^h y$

females which is due to the fact that in male embryos there is a greater tendency to abortion. The reason for this is not known.

Clinical Determination of Sex In recent years attempts have been made to influence sex determination by clinical methods. Unterberger states that the sex of the child is influenced by the reaction of the sperm and of the vaginal secretion. Where the product of the mixture of the two has an acid reaction female children predominate and males when the product is alkaline. To render the vaginal secretions alkaline various methods can be used. (a) douching the vagina with sodium bicarbonate solution 1 drachm to a pint, shortly before coitus (the change in the reaction does not last more than twelve hours). (b) inserting in the vagina 1 gramme of 50 per cent sodium bicarbonate. (c) powdering the glans penis with sodium bicarbonate. The second method is said to be the most effective. If a girl is desired lactic acid douches can be used. Unterberger recognises the importance of the x chromosome in sex determination but believes that the protoplasm of the male germ cell also plays a part, and that its reaction can be changed by altering the reaction of the medium in which it lives viz the vaginal secretion. His views have been much criticized and many more observations are necessary before they can be considered established.

Sex Linkage The x chromosomes do not contain only sex determining factors. They also contain many others and as they are all in the same chromosome they (i.e. the sex genes and the ordinary genes) will all be transmitted together. Thus the other character determinants in the x chromosome are linked to sex. This is known as *sex linkage* which is of great importance in human heredity.

An example of a Sex-linked Disease An example of a sex linked disease in humans is hæmophilia which is a sex linked recessive. Now it is well known that females while they may be carriers and transmitters of this disease do not themselves usually suffer from it. Males on the other hand if they are carriers of the disease always suffer from it and are of course transmitters as well. The reason for this difference will become clear from the following considerations. Let us suppose that we have a female carrier of hæmophilia. Her sex chromosomes are both xx and as the hæmophilia is sex linked the factor for it will be contained in one of the x chromosomes. This factor may be represented as x^b (x^b representing the sex chromosome carrying the hæmophilic gene)

have only space to include a few of the more important morbid characters but two have been already referred to above i.e. hæmophilia and colour blindness

Diabetes According to Lawrence about 25 per cent of diabetics show a hereditary element. The predisposition is probably inherited according to Mendelian principles but whether it is dominant or recessive is not determined. A complicating factor in the study of diabetic pedigrees is that there are probably in diabetic stocks many mild undiscovered cases or many who have inherited the predisposition (shown possibly by an abnormal sugar tolerance curve) to the disease which may or may not show itself later—depending on environmental factors. Lawrence states that the more numerous the affected members in the pedigree the greater is the chance of a diabetic transmitting the disease. If no relatives are or were affected (and before deciding this even apparently unaffected relatives must be carefully examined to exclude latent disease) we are justified in stating that in the present state of our knowledge there is no more likelihood of the children of a diabetic developing diabetes than there would be in the children of the general adult population. Further as stated above the more numerous the affected members in the pedigree the stronger is the probability that the disease or the predisposition to it will be transmitted and it is especially strong when diabetes occurs in the pedigree of both parents. Since the discovery of insulin has made the control of diabetes a relatively easy matter Lawrence considers that the possibility of a child developing diabetes does not now offer such an absolute ban as is presented by other and more fatal hereditary diseases. One doubts he says "if either the geneticist or the doctor is justified in doing more than outlining the position and leaving the ultimate decision to the patient".

Epilepsy Approximately 50 per cent of all epileptics have a family history of the disorder (Russell Brain). With regard to the risk of epilepsy in the children of an epileptic parent Echeverria found that 186 married epileptics had 533 children of whom 76 became epileptic. Brain concludes that on the whole we shall not be far wrong in assessing the expected incidence of epilepsy in the children of an epileptic parent as 10 per cent—that is if the affected individual has 10 children 1 is likely to be epileptic. As so many other factors than inherited predisposition play a part in the causation of epilepsy e.g. trauma syphilis cerebral arterio

The results of the union worked out in the same way as shown above will be —

$$x^h x^h, x^h y, x^h x, xy$$

that is one of the females will carry a hæmophilic gene in each of her x chromosomes will be a pure homozygous recessive and will therefore be hæmophilic. It is doubtful, however, whether such a mating has ever occurred and if it did whether a female carrying two such lethal genes could survive birth.

Finally it is important to note that a male member of a hæmophilic stock who is himself healthy (non hæmophilic) need have no fear of transmitting the disease. There is, however, no method of determining whether a female member of a hæmophilic stock is or is not a carrier.

Colour Blindness, a Sex Linked Abnormality

Another common example of sex linked inheritance in man is furnished by red-green colour blindness. Normal sight is dominant to colour blindness and the factor for the latter is again carried on the x chromosome and is thus sex linked. Thus should a woman who has normal sight but carries the taint mate with a normal sighted man all the female children will have normal sight, but half of them will carry the factor for colour blindness, while of the male children half will be colour blind and half will have normal sight. This may be worked out by the reader exactly as in the case of hæmophilia described above. The result of a mating between a normal female and a colour blind man may be worked out in the same way when it will be found that all the children have normal sight that the females are carriers of colour blindness, and that the males have normal sight and none of them carry the taint. Here, again a male who is not himself colour blind cannot transmit the abnormality. Red green colour blindness is almost entirely limited to the male sex, for it can only occur in a woman who is the daughter of a marriage between a carrier woman and a colour blind man.

• Inheritance of Other Morbid Characters

The study of human heredity is attended by many difficulties. Experiment is impossible and the only method available is the study of family pedigrees which are often unreliable. Families too, especially in modern times, are usually small, so that the normal Mendelian ratios are seldom able to show themselves. Here we

inherited from two normal parents one of whom must have been a carrier

Deaf Mutism It is necessary to exclude acquired deaf mutism as only the congenital variety can be hereditary. Of the 2400 deaf mutes in Britain only 1 in 7 owes his or her defect to morbid heredity. Hereditary deaf mutism appears to be a Mendelian recessive. Fig 17 shows a pedigree illustrating this recessive character of the abnormality. It will be noted that two normal daughters sprang from the marriage of two deaf mutes. The mother, however, was not a hereditary deaf mute but acquired total

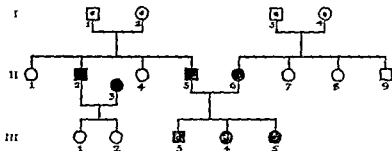


FIG 17 Deaf mutism (after Albrecht)

Explanation of Symbols

- Healthy male not a carrier
- Healthy female
- ◻ Healthy male but a carrier
- ◌ Healthy female
- Male showing the abnormality
- Female

deafness as a sequel to scarlet fever in infancy. It will also be noted that the children of the marriage of two hereditary deaf mutes were all deaf mutes. This is because deaf mutism being a recessive before it can express itself the factors for it must be double, namely carried in both members of an allelomorphic pair and thus in both parents.

Danger of Inbreeding among Diseased Stocks

Several illustrations have been given above concerning the danger of inbreeding between stocks both of which are tainted by the same hereditary disease. Deaf mutism forms one of the best illustrations of this especially as there seems not unnaturally, to be a tendency for deaf mutes to marry each other. Hæmophilia is another illustration though so far as is known to the author there is no record of marriage having ever taken place between a

sclerosis it is not yet known whether the predisposition is inherited on Mendelian lines

Polydactyly This is a hereditary character and according to Harris has been traced in one family for 700 years. It is dominant over pentadactyly is not sex linked, and has therefore no particular preference for either sex. If therefore a heterozygous polydactylous individual mates with one who is normal half the children (provided, of course the family is large enough for the normal Mendelian ratios to express themselves) will have six fingers and half will be normal. It is important to note, too that as polydactyly is a dominant character a member of a

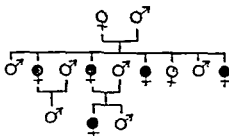


FIG 16. Harelip (Eugenics Records office).

Explanation of Symbols

- Healthy female possibly a carrier
 ○ male
 ● Female showing the abnormality
 ● Male

polydactylous family who is himself or herself normal need have no fear of transmitting the abnormality

Brachydactyly This condition, in which the fingers are very short and have only two joints each, is a Mendelian dominant. It is of interest to note that it was in this deformity that the Mendelian law was first proved to apply to human inheritance. Lenz quotes Farber as finding 92 normal and 99 brachydactylous individuals in the kinships a proportion that considering the small number involved is a sufficiently accurate approximation to the Mendelian 1 : 1 ratio (page 111) As the abnormality is dominant a normal member of a brachydactylous stock will not transmit it.

Harelip This would appear to be a recessive Mendelian character as is suggested by the family pedigree in Fig 16 for it will be seen that in the second generation the condition has been

CHAPTER VIII

MATURITY AND POSTMATURITY

PREGNANCY most commonly ends 280 days after the first day of the last menstrual period or 275 days after the last day. It is customary to reckon it from the first day of the last period as that date is usually definitely known. The expected date of delivery may be estimated by counting forward 280 days (40 weeks). A simpler plan is to count back three months from the first day of the last period, and add one year and seven days. If the whole of February is included *some* add two extra days.

This does not mean that the duration of pregnancy, namely, the conception-delivery interval, is 280 days. The length of this interval is not known with certainty. The insemination-delivery interval is often known accurately, but the conception-delivery interval is usually some days less. How many? The answer to this will depend on the length of life of the sperm after insemination. In the vagina it can only survive about twelve hours, but in the cervix and upper genital tract, though it has been found alive as long as seven and a half days after insemination (Hausmann), it is believed to be incapable of fertilizing the ovum after thirty-six hours (Hartman).^{*} The duration of pregnancy is probably, therefore, not more than two days less than the insemination-delivery interval.

The span of life of the ovum is also relatively short, and it is improbable that it is capable of being fertilized for more than thirty-six hours after ovulation and possibly less. Assuming that it cannot be fertilized more than thirty-six hours after ovulation, and knowing that ovulation may take place from the 9th to the 19th day of the menstrual cycle, it follows that conception (union of ovum and sperm) may occur at any time from the 9th to the 21st day of the cycle, and we can therefore fix the actual duration of pregnancy (conception-delivery interval), even when the time of insemination is unknown, with a possible margin of error of only twelve days.

Other considerations must, however, be taken into account. We know that embedding of the ovum does not take place till the 9th or 10th day after fertilization (Teacher) and that it must be embedded at least two days before menstruation is due

male bleeder and a woman who carries the taint Epilepsy and diabetes will furnish other examples

Heredity and Eugenics Having thus shortly described the general principles of heredity, it is not our intention to discuss at length their eugenic applications We shall refer to only two practical considerations that are already familiar to most First, the tendency of modern medicine is to hold in check the free operation of the principle of the "survival of the fittest," and thus to interfere with natural selection Preventive medicine, especially, tends to preserve the less fit elements of the population by saving them from going under in the struggle for existence A larger proportion than ever before of the physically and mentally unfit are now being preserved and indeed encouraged to procreate Secondly, largely because of this tendency to preserve the weak and to encourage their multiplication, in civilized communities, whatever increase in the population there is tends to be dysgenic Healthy stocks tend to become relatively fewer Numerous statistics could be quoted in support of these statements but the reader who is interested will find them in papers and books on eugenics

REFERENCES

- BRAIN RUSSELL In *The Chances of Morbid Inheritance* Edited by
C P Blacker 1934 Lewis London 73
LAWRENCE R D In *The Chances of Morbid Inheritance* Edited by
C P Blacker Lewis London 1934 332
LENZ FRITZ In *Human Heredity* By E BAUR L FISCHER and I
LENZ Allen & Unwin London 1931, 213
UNTERBERGER F *Deutsche Med Woch* 1930 56, 304
UNTERBERGER F *Ibid* 1932 2, 729

X-ray Examination of Ossification Sec p 546

Fœtal Mensuration Various methods have been devised by which the length of the fœtus may be measured *in utero*, and its maturity thus approximately estimated. They all depend on the fact that the mature child is hardly ever less than 50 cm long and that the length of the fœtus is twice its length from breech to vertex as it lies fully flexed *in utero*. None of them is sufficiently accurate or reliable to be of use in clinical practice and they will not be described here.

Cephalometry by X-rays It is possible by measuring the size of the fœtal skull by means of X rays to arrive at a more or less accurate estimate of the size and weight of the fœtus. Except in conditions where because of placental degeneration such as may occur in chronic nephritis or chronic hypertension, the fœtus is undernourished this is a reliable guide to its maturity. The methods in use are described on p 546.

Postmaturity

A search throughout literature reveals the fact that a belief in the possibility of the prolongation of pregnancy far beyond the usual period was held even in early times. Gellius Aulus for instance who flourished about 130 A.D. in his collection of incongruous matter called *Noctes Atticæ* stated that the Emperor Hadrian having consulted with the physicians and wise men, decreed that in cases in which the woman was of chaste manners and irreproachable conduct the child born eleven months after the death of the husband was legitimate. To come to more recent times, the Supreme Court of Friedland in 1634 decided that a child born 333 days after the husband's decease was legitimate. In modern literature many examples of alleged prolongation of pregnancy are reported more or less fully. Merriman from a study of 114 mature children, where the last day of the last menstrual period was known with certainty, discovered four (3.5 per cent) born from the 302nd to the 306th day. Reid gave the result of 200 cases in which the number of days from the last menstruation was known. Of these there were fourteen born between the 302nd and the 316th days. There was one child born on the 310th and one each on the 311th 314th 315th and 316th days. Von Winckel in a study of 30 500 labours, found thirty-one cases in which pregnancy, calculated from the first day of the last period had lasted from 302 to 322 days.

(Grosser) otherwise menstruation will not be inhibited and the ovum will be cast off with the shed menstrual decidua. Embedding must therefore be accomplished by at latest the 26th day of a twenty-eight day cycle. Fertilization if it is to result in pregnancy must not therefore take place later than the 17th day of the cycle. If we are correct in assuming that ovulation does not take place before the 9th day the margin of error in calculating the true duration of pregnancy need not be more than eight days and if the insemination date is known this may be reduced still further to two days or even none. These points are of practical importance when questions of maturity and postmaturity have to be considered and especially their medico legal aspects.

Estimation of Maturity

Have we any means of estimating maturity while the child is still in the uterus? The answer to this question is of the greatest practical importance when we have to consider the termination of pregnancy either by Cæsarean section or by induction of labour in for example cases of contracted pelvis or pre-eclamptic toxæmia.

Scrutiny of the Menstrual Dates It is always of prime importance to *scrutinize the menstrual dates* with the greatest possible care. Have the periods been regular before pregnancy began or has the patient been in the habit of missing a month or two occasionally? If so then a month or two of pathological amenorrhœa may have preceded the physiological amenorrhœa of pregnancy and the actual duration of pregnancy may be that much less than the total duration of amenorrhœa would indicate or immediately before the pregnancy there may have been one or two short periods which lasted only a day or two and which the patient has wrongly regarded as signs of threatened abortion. In estimating the duration of pregnancy these would have to be deducted. Valuable evidence may also be obtained from the date of quickening if this is known or again from palpation of the head either by the abdomen or better still by vaginal examination. The size of the head the degree of hardness of the bones and their mobility together with the width of the sutures and fontanelles may thus be estimated with a fair approach to accuracy especially by the examining finger in the vaginal fornices or by palpating the head through the open cervix. The state of the cervix too should be noted. If the patient is near term the cervix may be more or less taken up.

Date of Quickening Some help may be obtained from quickening, which usually occurs about the 16th or 18th week, or even from the time of onset of morning sickness. But there are so many fallacies in both these that any evidence they afford can be at best only confirmatory of conclusions based on more reliable data.

The size of the uterus, ascertained by a bimanual examination at the 2nd or 3rd month, would be very important. The presence, however, of a fibroid tumour in the wall of the uterus might cause confusion. After the 5th month the size of the uterus will be less convincing, for hydramnios or undue size of the foetus might make it larger. The result of a *Zondek Aschheim test* in the first days of pregnancy will rarely be available.

X rays are of little help though the existence of a very large ossific centre (over 5×5 mm diameter) in the cuboid would be confirmatory evidence of postmaturity. The ossific centre may, however, be of this size without the foetus being postmature (p 546).

Evidence in the Child after Birth *Excessive weight* is in itself no evidence of postmaturity, and a child may weigh 10 or 12 lbs without being postmature. Conversely a postmature child may not exceed the average weight.

Excessive length is more important but again is not reliable. The mature child usually measures from 50 to 52 cm but it may measure 60 cm without being postmature chiefly because hereditary factors come so much into play.

Weight and length have however, some value for if the child is small, or if its weight and length are not above the average it is strong, though not conclusive, evidence against its being postmature, and in order to establish postmaturity the collateral evidence must be correspondingly strong.

Ossification Little or no help can be obtained from ossification, for by this alone it is not possible to tell the age of a new born child within one month. The centre in the lower end of the femur is of no assistance, as it may be present in the premature child, and has been observed to measure as much as 3×5 mm in a child 41 cm long, and in which the duration of pregnancy did not exceed thirty five weeks. Then, again, it is absent in about 17 per cent of children at term, and therefore in a postmature foetus might be quite small. The cuboid is little more helpful for though the ossific centre usually appears at or just before birth it is somewhat variable, and it may be present in a foetus distinctly premature.

Confirmatory evidence of the possibility of considerable prolongation of pregnancy is obtained by a study of the duration of pregnancy in the lower animals. Earl Spencer studied this in cows in which the insemination date could be ascertained with accuracy. Over 700 were studied and it was found that while pregnancy most often ended 285 days after insemination in five it went over 300 days and in one case it lasted 313 days. Especially as the gestation periods of the cow and the woman are about the same the proved occurrence of post maturity in the cow constitutes strong evidence of its possibility in the human female.

Ætiology Regarding this we know next to nothing chiefly because we know so little about the cause of the onset of labour at the normal time. Possibly heredity plays some part for it has been observed that a mother and her two daughters have carried their infants longer than usual. The prolongation of pregnancy too tends to recur in the same patient. This tendency has been proved to exist in certain cases and it has been repeatedly observed in women. There is no evidence that the menstrual type such as prolongation of the menstrual cycle to thirty days or longer has any influence. Clinically we know that post maturity is more liable to occur when the foetal head is above the pelvic brim than when it is deeply engaged.

As indicating the possible importance of the rôle of a persistent corpus luteum in causing postmaturity it should be mentioned that Snyder succeeded in prolonging pregnancy in rabbits by three days beyond the usual term (i.e. to thirty five days) by injecting Prolan A and B so as to induce ovulation at the 20th day of pregnancy and the formation of a fresh set of corpora lutea at term. The foetuses were of excessive size and weight and were covered with hair.

Dangers Difficult labour from large size of the foetus and hardness of the head may endanger the life of the mother and child. Possibly the senility of the placenta may cause intra uterine death of the foetus but this is doubtful as the normal placenta has a large functional reserve and the child is usually born alive or at least is alive at the beginning of labour.

Diagnosis *The Menstrual History* When a patient goes a long way past the expected date of delivery the *menstrual history* must be scanned very carefully before it is decided that she is postmature. The various fallacies that may arise have been discussed previously (p. 124).

fact or circumstance has been adduced which in the slightest degree casts any reflection upon the chastity or modesty of the respondent, who has on oath denied adultery. I can only find her guilty if I come to the conclusion that it is impossible, having regard to the present state of medical knowledge and belief, that the petitioner can be the father of the child. The expert evidence renders it manifest that there is no such impossibility. In these circumstances I accept the evidence of the respondent, and find that she has not committed adultery, and accordingly I dismiss the petition."

It will be evident, then, that it is impossible, in the present state of medical knowledge, to fix an upward limit to the duration of pregnancy. If it may last for 331 days, why not 332? if 332 why not 333? and so on till the limits of credulity are exceeded. At the same time the greater the departure from the normal the more completely established must the evidence be. In the absence of conclusive medical evidence such cases usually turn upon the collateral question of the chastity of the woman. If no suspicious circumstances are elicited the case will generally go in the woman's favour.

Treatment. On account of the danger to mother and child arising from a difficult labour caused by the excessive size of the child and the undue ossification of its skull, it is always advisable to induce labour as soon as the fact of postmaturity is definitely established. While, however, it would be, strictly speaking, correct to term a woman postmature if she has gone more than eight days past her expected date it would be absurd to class her as abnormal, and therefore needing treatment. She could only be considered abnormal if she were exceptional, and it is certainly not exceptional for a woman to go eight days past her estimated date of delivery. A good clinical rule is that she should not be allowed to go more than a fortnight past her estimated date always provided that these dates have been correctly ascertained.

Induction of labour may conveniently be carried out by the castor oil, quinine and pituitary method (Appendix D) which is usually very effective in bringing on labour quickly in postmature women. In fact, so effective is it that it is sometimes used as a test of maturity, for in induction of premature labour the method is slow and uncertain. Should it fail a bougie or stomach tube should be inserted, or if preferred, and provided the head is engaged in the pelvis, the membranes may be artificially ruptured.

(thirty-six weeks), and may in the mature child measure as much as 5 mm in diameter. On the other hand it may be absent in the mature child.

In the postmature child the bones of the skull are usually harder and thicker than the average, and the sutures and fontanelles narrow and small. This is, however, not a matter that can be easily and accurately measured in the living child, but if there is other evidence of postmaturity undue hardness of the skull may be taken as supporting it; and on the other hand, if the skull bones are not unduly hard, and the sutures and fontanelles show no unusual degree of closure, the collateral evidence of postmaturity must be all the stronger.

We see therefore that there is no one specific sign of postmaturity in the new born child, but that at the same time several signs taken together, such as excessive length and weight, and an advanced degree of ossification, may be taken as strongly supporting the evidence obtained from other sources.

Medico-Legal Aspects. Important questions often arise respecting the legitimacy of postmature children. A husband, for example, might justifiably doubt whether a child borne by his wife eleven months after he had last cohabited with her was his own. We have already seen that the prolongation of pregnancy even to very long periods, is not uncommon in the lower animals and that there is no reason why its possibility should not be allowed in the human species also. Just where the limit is to be placed it is impossible to determine. The longest duration that has ever been allowed by the Courts in this country is 331 days from the date of cohabitation (*Gaskill and Gaskill*). In this case Mr Gaskill brought an action for divorce against his wife, the main facts being as follows. The petitioner, Mr Gaskill, a soldier at the time, was granted leave from September 29th till October 3rd, 1918. He overstayed his leave by one day, and returned to duty on October 4th. He admitted intercourse with his wife on that date. He then left for Salonica and did not return to this country till September, 1919. On September 1st, 1919, his wife gave birth to a child the lapse of time since his departure being 331 days. Her doctor said that the child was unusually large at birth, and the labour prolonged. He had not weighed the child at birth, but judged it to be about 11 lbs. The following is an extract from the judgment of the Lord Chancellor: "The only evidence of adultery was the abnormal length of the pregnancy. No other

CHAPTER IX

ABNORMAL PRESENTATIONS AND POSITIONS

Occipito Posterior Positions

POSTERIOR positions of the vertex form perhaps the commonest complication of labour. Their recognition in the antenatal period is therefore of the greatest importance especially as in many cases the malposition can be rectified before the onset of labour. By far the commonest is the right occipito posterior, which is met with in about 20 per cent. of pregnancies at or near term. The left occipito posterior is rare probably because the left posterior quadrant of the pelvis is occupied by the pelvic colon. Occipito posterior positions are said to be particularly liable to occur in the male type of pelvis (p. 258).

Diagnosis. Recognition in the antenatal period is not always easy. The following points will help —

(1) *Contour of the Abdomen.* In anterior positions of the occiput the abdomen below the umbilicus usually presents a rounded contour from above downwards owing to the abdominal wall being pushed forward by the well flexed back. In posterior positions this rounded contour is less marked and the abdominal wall falls away abruptly toward the pubes.

(2) *Non engagement of the Head.* The foetal head is often found to be not engaged even at the 37th week or later and it has already been pointed out that the occipito posterior position is one of the most frequent causes of this condition (p. 36). This is partly because the head owing to the extension of the spine always tends to become extended so that a longer diameter lies across the pelvic brim and partly because with the occiput posterior, the wide part of the head namely that behind the biparietal diameter has in engaging to enter the narrow part of the pelvic brim.

(3) *Absence of the Convexity of the Back.* On lateral palpation one misses in posterior cases the well defined convexity and resistance of the back that is usually so easily determined in anterior positions. If, in the latter the fundus is pressed downwards the back becomes more prominent, and its convexity underneath the abdominal wall more easily defined. In the occipito posterior case

REFERENCES

- GROSSER, O "Frühentwicklung, Eihautbildung und Placentation" München, 1927
- HARTMAN, CARL G "Sex and Internal Secretions," 1932. Williams and Wilkins Coy. Baltimore, 647-733
- HARTMAN, CARL G "Time of Ovulation in Women - A Study on the Fertile Period in the Menstrual Cycle" Baillière, Tindall & Cox, London, 1936.
- MERRIMAN, S *Medico Chirurg. Trans (Lond)*, 1827, 13, 338
- SNYDER, F W *Bull Johns Hopkins Hosp*, 1934, 54, 1.
- SPENCER, EARL. *Veterinarian*, 1839, 12, 722.
- TEACHER, J H *Jour. Obst and Gyn Brit. Emp*, 1924, 31, 166.
- VON WINCKEL, F. *Samml klin Vortrage*, 1901, N.F., Nos 292 and 293, 175

CHAPTER IX

ABNORMAL PRESENTATIONS AND POSITIONS

Occipito-Posterior Positions

POSTERIOR positions of the vertex form perhaps the commonest complication of labour. Their recognition in the antenatal period is therefore of the greatest importance, especially as in many cases the malposition can be rectified before the onset of labour. By far the commonest is the right occipito posterior, which is met with in about 20 per cent. of pregnancies at or near term. The left occipito posterior is rare, probably because the left posterior quadrant of the pelvis is occupied by the pelvic colon. Occipito posterior positions are said to be particularly liable to occur in the male type of pelvis (p. 258).

Diagnosis. Recognition in the antenatal period is not always easy. The following points will help —

(1) *Contour of the Abdomen.* In anterior positions of the occiput the abdomen below the umbilicus usually presents a rounded contour from above downwards, owing to the abdominal wall being pushed forward by the well flexed back. In posterior positions this rounded contour is less marked and the abdominal wall falls away abruptly toward the pubes.

(2) *Non engagement of the Head.* The foetal head is often found to be not engaged even at the 37th week or later, and it has already been pointed out that the occipito posterior position is one of the most frequent causes of this condition (p. 36). This is partly because the head, owing to the extension of the spine, always tends to become extended so that a longer diameter lies across the pelvic brim, and partly because with the occiput posterior, the wide part of the head, namely that behind the biparietal diameter, has, in engaging to enter the narrow part of the pelvic brim.

(3) *Absence of the Convexity of the Back.* On lateral palpation one misses in posterior cases the well defined convexity and resistance of the back that is usually so easily determined in anterior positions. If, in the latter the fundus is pressed downwards the back becomes more prominent, and its convexity underneath the abdominal wall more easily defined. In the occipito-posterior case

this sign is absent. The convexity and resistance of the back, too, in anterior cases will be found at the level of the umbilicus, to come up close to the middle line. In posterior positions the back, or the side of the chest, will be found far out in the flank, generally the right and far away from the mid line.

(4) *The Position of the Limbs* The limbs are more easily

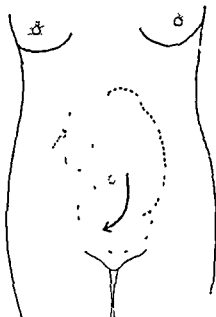


FIG. 18. Palpating the Anterior Shoulder. The arrow indicates the direction in which the examiner palpates in order to map out the anterior shoulder. (Windeyer.)

palpated than in anterior cases and often lie more towards the mid line or even on both sides of it.

(a) *Palpation of the Anterior Shoulder* The value of this has been especially emphasised by Windeyer, of Sydney, who describes the method as follows: "Next" (after palpating the back) 'turn and face the patient's feet, trace the resistance of the back from the level of the umbilicus downwards till it disappears or becomes deeper at the groove of the neck (Fig. 18) and below this one feels the firm, resistant head. The anterior shoulder is recognised as follows. Place the corresponding hand over the back, trace its resistance downwards, then bend the fingers into the groove of the neck (Fig. 19) and carry out palpation upwards till

the top of the shoulder is felt, note the level above the symphysis and the distance from the mid line at which it is felt. In anterior positions of the occiput the shoulder is close up to the mid line and on the same side as the back, whereas in posterior positions it is usually 7.5 centimetres (three inches) away from it" (Figs 20 and 21)

(6) *Pelvic Palpation* By this is discovered the actual diameter

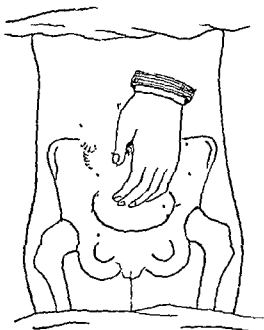


FIG 19 Palpating Anterior Shoulder The left hand is placed over the scapular back the fingers are flexed and palpate upwards to map out the top of the anterior shoulder (Windeyer)

of the pelvis in which the head lies Stand facing the patient's feet and place the hands symmetrically above the pelvis one on either side of the mid line Press the fingers (Fig 22) (or the index finger alone may be used) directly backwards, and on one side it will be found that there is less resistance, and the fingers sink deeper This is the diameter in which the head is lying Thus, if the fingers sink deeper on the right side it is because this side of the pelvis is empty, and the head is in the right oblique The position must be, therefore, either a first or third vertex, and if now the back is found to be absent on the left side and in front

(its position in a first vertex), the diagnosis of right occipito-posterior is established



FIG 20 Palpating the Anterior Shoulder in a first vertex (LOA). The shoulder is close up to mid line and 2 inches above symphysis. The head is engaged. The right thumbnail indicates the top of the symphysis pubis. (Contrast with FIG 21) (Windeyer)



FIG 21 Palpating the Anterior Shoulder in a fourth vertex (LOP). The shoulder is 3 inches from the mid line and 4 inches above the symphysis pubis. The head is not engaged. (Contrast with FIG 20) (Windeyer)

(7) *Position of the Fetal Heart Sounds* In occipito-posterior positions the heart sounds are typically heard far out in the corresponding flank, i.e., in the right flank in right occipito

posterior positions. It is however, not uncommon to hear them quite well in the position of first or second vertex, in right and left occipito posterior positions respectively, because of the extension of the foetal spine that so often occurs, throwing the chest forward against the abdominal wall. This is often of bad prognostic significance, for it means, as Miller has pointed out, that the head is also badly flexed, that it is therefore likely to engage late and badly in the pelvis, and that the membranes will therefore prob-

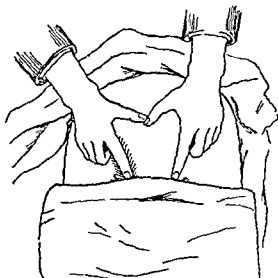


FIG 22 Method of finding the diameter of the pelvis in which the foetal head is engaged (Windeyer)

ably rupture early. In the great majority of these cases the occiput will fail to rotate during labour.

In other cases the foetal heart sounds are heard not at all or only faintly, over a wide area without any point of maximum intensity. This indicates a completely posterior position of the back, and the occiput may in such cases take a long time to rotate if it does so at all.

Treatment. In view of the delay in labour that so often occurs in occipito posterior cases, of the anxiety that they cause to the medical attendant, and of the frequent necessity for manual rotation, any treatment that offers a fair chance of correcting the malposition before labour starts is to be welcomed. Various external manipulations have been advised from time to time but none met with much success till R. C. Buist, of Dundee, in 1921

described his method of rotation by pads. His description of the procedure is as follows: 'A binder is laid under the patient and two towel pads are prepared. The first is rolled to the thickness of the forearm, the second is folded to a flat pad 6-7 inches square. The rolled pad is pinned to the binder in such a position that when the binder is firmly secured the pad will lie closely in front of the anterior superior spine behind and parallel to the trunk. The flat pad is pinned so as to lie on the limbs pressing them backwards. It is sometimes useful to roll the patient to the side opposite the trunk and by hand roll the trunk as far as may be over to that side. The binder is then pulled firmly home. If the patient is actually in labour nothing more may be needed but if she is still on foot the binder should be steadied by thigh bands and the correction of its position frequently supervised. When in bed the patient should be encouraged to lie on the side opposite to the trunk but her comfort is a prior consideration.

This method is successful in about 70 per cent of cases. If the head has not been previously engaged it often sinks into the pelvis after rotation has occurred and there it remains. Needless to say before the pads are applied the bowels and bladder should be emptied. It is usual to apply the pads about a week before the expected date of delivery though they can be applied even after labour has begun.

The patient may bring her own binder (a bolster case does very well) two large towels and half a dozen very large strong safety pins. The pads are applied and the patient is allowed to go home and go about her ordinary duties returning twenty four hours later. The binder and pads are then removed and the position examined. If rotation has taken place an attempt should be made to push the head into the pelvis. Some deny that the method is successful unless the head is in an occipito lateral position and assert that as in such cases the occiput always rotates forward during labour pads are unnecessary.

Breech Presentations

Ætiology Vartan has recently pointed out that the cause is to be found in any condition that interferes with spontaneous version the likelihood of which increases as term approaches. Contracted pelvis is not a cause as was formerly thought for in his analysis of cases of disproportion from various hospitals he found that the frequency of breech presentation was only 1 per

cent and therefore no greater than its frequency among the whole population of child bearing women. Much the same argument applies to placenta previa though the incidence of breech presentations viz 8 per cent was less striking. Ince and Young, too in their radiological and clinical study of pelvic sex characters including the area of the pelvic inlet did not find any correlation between them and breech presentation. The chief causes of breech presentation may be therefore classified as follows (1) Prematurity (2) Extended legs by interfering with spontaneous version (3) Multiple pregnancy on account of the mechanical obstacle to spontaneous version caused by the presence of more than one foetus. In 22.9 per cent of Vartan's cases no cause could be found.

Diagnosis Diagnosis of a breech presentation before the 33rd week is of no importance as spontaneous version usually occurs up to that time. After the 33rd week however it becomes of great importance especially in the primigravida because of the necessity for carrying out prophylactic external version.

The following methods will be found useful —

(1) *The head lies at the fundus* and is recognised by its hardness roundness and mobility all of which distinguish it from the softer more indefinite and less mobile breech. It may be possible too to make out the groove between the head and the back. The softer and more indefinite breech is found at the pelvic brim. Occasionally the head may especially if the foetus is large and the woman of small stature be tucked away under the ribs and far back so that it is impossible to feel it. Diagnosis may then be made by the failure to feel the head at the pelvic brim or in the pelvis.

(2) *Ballotting the Head* If the head is gently tapped with the tip of the forefinger it floats away from the finger and then back against it once more. This is very characteristic and is never found in the case of the breech. This sign may be absent if the legs are extended or if there is little liquor amni.

(3) *The Fœtal Heart Sounds* These are usually best heard a little above the umbilicus and to one or other side. Their exact level depends a great deal on whether the breech is engaged in the pelvis. If it is deeply engaged they may be best heard below the umbilicus.

(4) *Vaginal examination* may, very rarely, be necessary for diagnosis especially in a stout primigravida. The hard skull

bones can usually be recognised with certainty, even through the vaginal fornices if the vertex is presenting

(5) *X rays* In hospital practice X rays are commonly used in doubtful cases. They are especially useful in diagnosis of extended legs

Diagnosis of Extended Legs This is very important from the point of view of treatment by external version and also with regard to the outlook for the labour should attempts at version fail. Besides X rays the chief diagnostic points are (a) The head does not ballot easily or well possibly because the spinal ligaments and muscles are more taut the spine being splinted by the legs. (b) The breech is usually engaged in the pelvis

Treatment Before the 30th week no treatment is necessary as up to that time and sometimes even after, spontaneous version may occur. About the end of the 30th week prophylactic external cephalic version first practised by Herbert R. Spencer in 1901 should be carried out because of the risk to mother and child from a breech delivery—risks which are much greater in primigravidae than in multiparæ. It should not be delayed much longer than this as the foetus grows so large and the liquor amni becomes relatively so much less that version may become very difficult

External cephalic version may also be advisable when there is reason to suspect disproportion between the sizes of the head and the pelvic inlet for it is obviously impossible to estimate the degree of disproportion unless the vertex is presenting

Steps (1) The question of anæsthetic. As a rule no anæsthetic is necessary or desirable and a trial should always be made first without it. If the attempt fails and it is considered that an anæsthetic would help for example in overcoming rigidity, there is little objection to giving it provided the patient is not long under it and it is not made an excuse for ungentle manipulations. Gas and oxygen rarely give sufficient relaxation and chloroform is pleasanter for the mother than ether and safer for the child. It is a good plan to induce with chloroform or ethyl chloride and continue with ether but a long anæsthetic must be avoided

(2) The bladder and bowels should be empty

(3) If the breech is engaged in the pelvis it must be got out. This can be done by putting the patient in the Trendelenburg position by raising the foot of the couch about 2 feet for half an hour. If this is not successful it should be displaced by pressure with the fingers *per vaginam*

(4) The foetus must be outlined to find on which side the back lies. This is necessary because the foetus is to be turned in such a direction as to maintain and increase flexion. If this is not done it may be converted into a brow or face presentation. An X ray picture is usually necessary to give the exact information required.

(5) Having outlined the foetus the foetal heart sounds should be counted.

(6) Pressure is now made on the occiput so as to increase the flexion of the vertex and press the chin further downwards on to the sternum. Further pressure then flexes the spine and pushes the foetus round till its head lies above the pelvic brim. To assist this movement the breech may at the same time be brought upwards towards the fundus with the other hand.

(7) The head should now be pushed as far as possible into the pelvis. This may be assisted by firm pressure on the fundus.

It is always advisable to keep the patient in bed for two or three days after, and to prevent recurrence it is well to put on a lateral pad on each side of the abdomen and a binder.

(8) The foetal heart sounds should always be counted again after the version has been completed. They may be much slower than before version was attempted and often are down to 80 per minute or thereabouts and may be irregular or even stop altogether though that is very rare. Should any of these abnormalities occur the sounds should be continuously observed for a time. Usually they return quickly to normal, but should they not do so it may be necessary to turn the foetus back to its former position retracing the steps by which version was accomplished.

Difficulties Sometimes all efforts to get the foetus round prove unsuccessful, even under anaesthesia. These are usually cases with extended legs, which seem to splint the body and prevent flexion of the spine. Version is not always impossible, however, when the legs are extended—so much depends on the size of the child and the amount of liquor amni. and in University College Hospital during the last three years it was successfully accomplished in 44 per cent of all the cases in which the legs were extended. Difficulty too may be encountered if the pregnancy is too far advanced, though spontaneous version not infrequently occurs at term. An example of this proved by X ray examination, is recorded by Findlay. The child was born twenty four hours later and weighed 7½ lbs. There was no unusual amount

College Hospital Of patients after the 32nd week of pregnancy, and including cases dealt with under anæsthesia version was successful in 76 per cent of those in the primigravida group and in 94 per cent in the multiparous group. The risk of premature labour being induced by attempts at version was found to be negligible when the operation was performed without an anæsthetic. With anæsthesia premature labour occurred in 8 out of 40 cases. All these patients had already advanced to at least the 37th week of pregnancy. Amongst 201 versions performed without anæsthesia there was no instance of hæmorrhage occurring as the result of manipulation when the manipulations were performed under anæsthesia bleeding was provoked in 6 out of 92 patients. The bleeding was never severe but the associated placental separation was apparently responsible for foetal death on two occasions. Macfarlane and McClure report a foetal mortality from version of 0·4 per cent in a series of 134 patients.

Contra indications (1) In an elderly primigravida attempts at version are usually undesirable as they entail too much risk to the fœtus unless it goes round easily without an anæsthetic. Cæsarean section at term is otherwise the best treatment.

(2) Multiple pregnancy is an absolute contra indication.

(3) In placenta prævia version should not be attempted because (a) the risk of hæmorrhage is too great and (b) breech presentation has many advantages from the point of view of treatment.

(4) If the foetal head is hydrocephalic it is best to allow the patient to go into labour with the breech presenting. The spinal canal with after coming head can be easily punctured after the body is born.

If Attempts at External Version Fail We are then faced with a breech delivery with all its possible difficulties and dangers to the child. Before undertaking this it is necessary to know exactly the size and shape of the pelvis. This always involves an X-ray pelvimetry (p. 553) for only if the pelvis is roomy are we justified in allowing delivery by the natural passages. This is always necessary even in a young primigravida. In an elderly primigravida even with a normal pelvis the risks to the child of breech delivery are such as to justify Cæsarean section unless there is some contra indication.

Shoulder Presentation

Shoulder presentation may occur in women with contracted pelvis, pelvic tumours, placenta prævia or any other condition

that interferes with the entry of the head into the pelvis. It most commonly occurs, however, in multiparæ who have had many easy labours, and whose pelvis is not contracted. It may in such cases be due to hydramnios, often of slight degree, or to uterine obliquity associated with lack of tone in the uterine and abdominal muscles.

Diagnosis Inspection shows that the uterus is a little wider than usual from side to side, and the fundus may be less high. On palpation the head may be found in the iliac fossa, and the breech high up on the other side. The *fœtus* really lies obliquely across the uterine axis, not quite transversely.

Treatment Contracted pelvis must always be excluded by the obstetric history and pelvic measurements. The possible presence of pelvic tumours, especially an ovarian cyst, should be kept in mind.

Let us assume that both these conditions are excluded and that the patient is a multipara with a good obstetric history and a normal pelvis. It is unnecessary to do anything before the end of the 35th week. At or after that time external cephalic version should be carried out in the same way as in breech cases. The operation is usually very easy, especially if the head is below, but there may be difficulty in maintaining the new position, if there is some hydramnios. She should be kept in bed afterwards for two or three days with lateral pads and a firm binder applied so as to push the fundus downwards in the hope that the head will sink into the pelvis. As most occur in multiparæ, however, it rarely does so, and it is necessary to keep the patient under observation at regular intervals. Sometimes, in spite of repeated version the transverse lie has recurred by the time labour sets in. Version should then be done again, and especially if there is hydramnios, puncture of the hind waters. This effectively fixes the head. If there is contracted pelvis, Cæsarean section at term is usually the best treatment.

Face Presentation

This presentation may also occur in any condition, such as contracted pelvis, that prevents the normal engagement of the vertex, but like the transverse lie it usually occurs without any obvious cause in a woman with a normal pelvis and no disproportion. It may in such cases be due to a pendulous abdomen or to a lateral obliquity of the uterus, both predisposed to by lax abdominal walls. The uterine force thus misdirected tends to

push the chin downwards and cause extension of the head. This is particularly apt to occur in posterior positions of the occiput after the onset of labour, the wider occiput being held up in the narrow posterior part of the pelvis behind the sacro cotyloid diameter while the forehead is free to descend. This movement usually results only in some extension of the head, but if it proceeds to its full extent a face presentation with the chin anterior is produced.

Diagnosis A face presentation is but seldom found in the antenatal period as it usually occurs for the first time after labour sets in (especially by extension of a right occipito posterior)—a secondary face presentation. It is, however, easily recognised. The head is above the pelvic brim, and in dorso anterior cases the groove between the occiput and the shoulders is readily seen and palpated. The depth of the groove distinguishes between a face and a brow. At the lower part of the abdomen the back is not easily felt, as on account of the extension of the head the upper dorsal region is not closely applied to the abdominal wall. At the upper part of the abdomen the buttocks and sacrum may be unusually prominent. For the same reason that prevents the back being felt, the foetal heart sounds are not easily heard. If the back is behind, the findings are much less characteristic, as the deep groove between the occiput and shoulders is out of reach, but sometimes the chin may be felt on pelvic palpation, as a horseshoe like rim, or a sharp projection dipping down into the pelvic cavity, or lying in the plane of the pelvic inlet. The chest is thrown forward against the abdominal wall, so that the limbs are easily palpated, and the foetal heart sounds are heard with unusual clearness in the position of the first or second vertex.

Treatment If there is contracted pelvis the case should be treated from that point of view. Cæsarean section will then nearly always be best for mother and child. If contracted pelvis and pelvic tumours are excluded, the best plan is usually to allow the patient to go into labour with the face presenting. Most authorities consider that the results of face delivery are so good that attempts during the antenatal period to turn the face into a vertex by external manipulation are unnecessary. Indeed, they are generally useless. A method, that of Schatz, is described, wherein by external manipulations the prominent chest is pushed backwards and the breech downwards, so as to cause flexion of

the spine and therefore of the vertex. The method is difficult, and if it only partly succeeds may bring about a brow presentation much more unfavourable than a face. Besides, it is only possible when the chin is anterior, and these are the most favourable if left alone. The two chief additions to the Schatz manoeuvre, those of Thorn and Baudelocque require internal manipulations and are only suitable after labour has begun.

A face presentation in an elderly primigravida is always best treated by Cæsarean section.

Brow Presentation

A brow like a face presentation may occur without any obvious cause. There may be however a slight degree of dolichocephaly or a flat pelvis, or a lateral or anterior obliquity of the uterus (pendulous abdomen) which acts in the same way as in face presentations viz., by pushing the chin downwards and thus causing extension.

Diagnosis. The head is above the pelvic brim. If the occiput is anterior it is usually possible to feel the groove between occiput and back. It is not so deep as in face cases and the vertex is less extended. On pelvic palpation the head is felt well on both sides but the sinciput is lower than the occiput. It may be possible, if the patient is well relaxed and the abdominal wall thin, to palpate the chin and the unusually long mento vertical diameter may arouse suspicion. No definite information will be gained by vaginal examination in the antenatal period, except that the presenting part is a head, and that it is very high up.

Treatment. It is most important to try to find some cause for this malpresentation and especially to exclude contracted pelvis and tumours of the soft parts. Even contracted pelvis of very slight degree justifies Cæsarean section. This is the best treatment too in the elderly primigravida or in any woman who demands a living child.

If none of these indications for Cæsarean section is present, and it is decided to allow natural labour to ensue there is no harm in making an attempt to convert the case into a vertex. As in face cases the method is only likely to be successful if the chin is anterior. The prominent chest should be pushed backwards while at the same time the breech at the fundus is pushed down. This flexes the spine, and with it the vertex. While this attitude of flexion is maintained, an assistant may try to increase the

flexion of the head by pulling the chin upwards and pressing it towards the sternum. The vertex should then be pushed as far as possible into the pelvis and kept there by a tight binder. If the occiput is anterior it is generally impossible to reach the chest. The breech however can still be pushed downwards and greater purchase can be obtained on the head through the prominent occiput. The occiput can therefore be pressed downwards at the same time as the chin is pressed upwards towards the sternum. Unless however the spine can be flexed extension of the head will inevitably recur.

If this manœuvre fails the choice lies between Cæsarean section and allowing the patient to go into labour with the brow presenting. Each case must be treated on its merits. Fortunately, many of the brow presentations become spontaneously converted into face presentations in the course of labour. Should this fail to occur, lower segment Cæsarean section after a fair trial of labour is usually the best treatment for mother and child. In the management of labour the possibility of this eventuality should be borne in mind and vaginal examinations and manipulations avoided as much as possible.

REFERENCES

- BUIST R C *Brit Med Jour* 1901 21 780
 FINDLEY P *1st Jour Obst and Gyn* 1924 8 641
 INCE J G H and YOUNG M *Jour Obst and Gyn Brit Fip* 1910 47 130
 MACAFEE C H G and McCLEURE H I *Brit Med Jour* 1937 2 1112
 MILLER DOUGLAS *Trans Ed n Obst Soc* 1906-7 46 77
 SPENCER H R *Brit Med Jour* 1901 2 1192
 VARTAN C KEITH *Lancet* 1910 2 595
 WHITE NORMAN and ILEW J D S *Brit Med Jour* 1931 2 346
 WINDVEYER J C *Med Jour Australia* 1931 1 551

CHAPTER X

MULTIPLE PREGNANCY

THE incidence of twin pregnancy is usually about 1 in 80, but it varies somewhat with race and climate. Generally speaking, the incidence is highest where fertility is greatest. Engelhorn gives the following figures for different countries: Russia 1 in 418, Sweden 1 in 816, Switzerland, 1 in 845, France, 1 in 99. Spain 1 in 1136. Veit gives the following statistics of multiple pregnancy among 13 million births: Twins, 1 in 89, triplets 1 in 7910, quadruplets, 1 in 371,126. Of quintuplets about thirty cases have been reported, while sextuplets have been described three times. An account of the recent famous case of the Dionne quintuplets will be found in the *Journal of the American Medical Association*, September 1st, 1934.¹

Uniovular and Binovular Twins The fetuses may both come from one ovum—uniovular or homologous twins, or from two separate ova—binovular or fraternal twins. Binovular twins are not necessarily of the same sex, and are no more alike than any two members of the same family usually are. Uniovular twins are always of the same sex and are very similar in appearance and mental characteristics. They are therefore known as identical

Dr. A. R. Dafoe's description of the birth of the Dionne quintuplets is as follows: "At 4 a.m., May 28th (1934) a 'hurry call' came from the Dionne home (at Callander, Ontario). I arrived to find the home in confusion and no preparation made for the confinement except a tea kettle boiling on the stove. Two babies had already been born and a third was just making its appearance over the perineum. Two neighbours were acting as midwives. The father had disappeared. I scrubbed up in the best way available, took over the situation and delivered the third baby. The neighbours then scurried around the house to get some wrappings for the babies and replenish the fire. In the meantime another amniotic sac was presenting itself at the vaginal orifice and a little pressure over the abdomen brought another baby into the world. This one was followed by still another. The last two babies were born within intact amniotic sacs and could be seen moving their arms and legs through the transparent walls. In the early hours of the morning and still sleepy from a previous obstetric case the same night the whole situation seemed to be unreal and dreamlike but I mechanically went about the business of looking after the babies. I did not see how all the babies could possibly live so I baptised them separately." Apart from shock and some postpartum hemorrhage and later a phlebitis in the right saphenous vein the mother did well. The placenta was single, irregular in outline with the cords emerging from it at various points. "The babies appear to resemble one another considerably" and were all girls. Their combined weight at birth was 13 lb. 6 oz. All are still alive and thriving. Unfortunately the placenta was destroyed during the doctor's absence on a hurried five-mile journey to fetch a priest to the mother who had collapsed from shock.

twins. Studies of such pairs of identical twins, however, invariably show minute differences with regard to hair, complexion, colour of iris, refraction of the eyes, etc. Finger prints are never identical but the blood groups are necessarily the same.

Origin of Binovular Twins. They may arise from (1) fertilization at or about the same time of two ova resulting from rupture of two separate Graafian follicles, either in the same or in separate ovaries, or (2) fertilization of two ova from one follicle. That the latter is the usual method is shown by the fact that in twin pregnancy it is unusual to find more than one corpus luteum, and the occurrence of two ova in one discus proligerus is not uncommon.

Origin of Univolar Twins. Univolar twins result from the complete separation of blastomeres in the early stages of segmentation. If the separation is incomplete, one or other of the varieties of conjoined twins is produced. As to why some eggs develop into single embryos and others into homozygous twins it is not easy to dogmatise. The question has in the case of

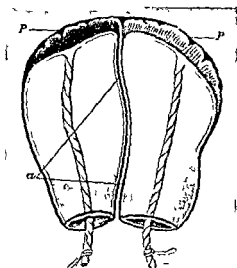


FIG 24 Arrangement of Placentas and Membranes in binovular twins (Bumm)

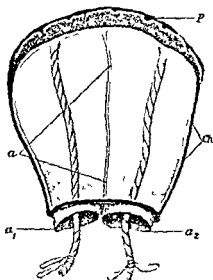


FIG 25 Arrangement of Membranes in uniovular twins a_1 a_2 . Amnion Ch. Chorion P Placenta (Bumm)

mammals been studied in the nine-banded armadillo which normally gives birth to sets of uniovular quadruplets. In that animal the egg on entering the uterus floats about for some three weeks before embedding itself. During this period owing to oxygen and food starvation development is temporarily arrested to be followed by acceleration of growth consequent upon nidation leading to bud formation which results in multiple uniovular embryos (Budding and Fission Theory Stockard Newman).

Attractive as this theory is inasmuch as it could be applied to twinning in man on the supposition that owing to delayed development of the corpus luteum the uterine mucosa is not ready for the reception of the ovum it cannot be considered as valid because the same delayed nidation occurs in the badger without the production of identical twinning. Hence it is probable that the phenomenon in human embryogenesis is due to some genetic constitution of the zygote such as weakness of the cohesion of the cells of the segmenting ovum.

Pelate's Frequency of Uniovular and Binovular Twins. About 20 per cent. of all twins are uniovular and about 40 per cent. of all twins of the same sex are uniovular. An analysis of over 100 000 twins showed a proportion of 17 sets of like-sex twins to 10 sets of unlike sex. Now if all these twins had been binovular there should have been just as many pairs of like-sex as unlike-sex since the following events would have occurred with equal frequency —

- | | |
|--|--------------------------|
| (1) Both males | } = 2 sets of like-sex |
| (2) Both females | |
| (3) First child male and second child female | } = 2 sets of unlike sex |
| (4) First child female and second child male | |

Hence 7 sets of like-sex twins out of 27 sets of all kinds of twins i.e. 26 per cent. and 7 sets of like-sex out of 17 of like-sex twins i.e. 41 per cent. must have been uniovular (see Feldman, *Biostatistics* 2nd edition 1935 pp 396 and 397)

Placentation. The placentas of binovular twins may be entirely separate and distinct from each other (6 out of 57 binovular placentas in University College Hospital). Usually however they are joined at their margins but the junction is usually so loose that they can be separated without any tearing of tissues. Sometimes a distinct groove can be seen between the two or they may be joined by a thin membrane. The circulations are separate no anastomoses existing between them.

Kadjar has recently claimed that there is sometimes an anastomosis present, and he found it in 4 out of 27 cases. In one of the three that were fully studied there was a superficial anastomosis between two arteries and another between two veins, in a second there were two superficial inter-arterial anastomoses and one inter-venous; in the third there was a superficial inter-venous anastomosis and a deep arterio-venous. If these observations are confirmed they will raise the question of the possible occurrence in the female twin when they are of different sexes of a condition known in cows as the sterile freemartin. This is a sterile female twin with certain male secondary sex characters believed by some to be due to the passage of hormones from the male to the female twin. It must be said, however, that in 57 binovular placentas studied since the publication of Kadjar's work by Gladys H. Dodds and the author, an intercommunicating circulation has not been found once.

The arrangement of membranes in binovular twin placentas is characteristic (Fig 24). Though generally loosely joined at their adjacent edges, each placenta has developed separately, and has its own amnion and chorion, and each foetus therefore occupies a separate sac. The partition between the sacs is composed of four membranes arranged in the following order: amnion chorion chorion, amnion. The two chorions are sometimes fused.

In uniovular twins there is always a single placenta which is usually a good deal larger than normal. There is a single chorion, but nearly always two foetal sacs, the partition between them consisting of two layers of amnion with no chorion between (Fig 25). In some cases a partition is entirely absent, and then the foetuses occupy a common sac (mono amniotic twins). This may arise from their having a common amnion from the start, or from the breaking down of the existing amniotic partition by excessive foetal movements, or excessive pressure of liquor amni. Mono amniotic twins (not including conjoined twins or double monsters) are rare. Quigley states that 109 cases have been reported. In such the umbilical cords may be entirely separate or they may join toward their placental ends and thus have a common insertion. Separate cords, too, may become twisted or knotted together, thus causing the death of one or both foetuses. According to Quigley, the foetal mortality is 68 per cent. The circulations in uniovular placentas always communicate through the so called third circulation. The nature of the anastomoses has been studied by Schatz who divides them into the following groups:—

- (1) Placentas with deep anastomoses only (one of 24 cases examined)
 - (2) Those with a single (seldom double) superficial arterial anastomosis, in addition to several deep anastomoses (15 out of 24)
 - (3) Those with one (seldom two) superficial venous anastomoses in addition to several deep anastomoses (1 out of 24)
 - (4) Placentas with one (seldom two) surface arterial and one venous anastomosis in addition to several deep anastomoses (7 out of 24)
- The deep anastomoses are always between vessels of opposite kinds, i.e., between artery and vein, and are as many as ten to twenty in

number. The superficial anastomoses are always between vessels of the same kind, namely, artery with artery or vein with vein.

These communications between the two circulations in uniovular twins are of profound importance from a pathological standpoint. Not only do they almost certainly play a leading rôle in the production of hydramnios, but in them is to be found in all probability the explanation of the not infrequent death of one of the fetuses. According to Logelhorn, death of one fetus *in utero* occurs three times as often in uniovular as in binovular twins. The usual explanation is as follows. If one fetus has a stronger heart than the other, the circulation in the hypogastric arteries of the weaker will be reversed and its placental circulation thus brought to a standstill. When one fetus dies it is usually retained till delivery of the other and is then expelled with it. In the meantime the fluid in the tissues of the dead fetus and the liquor amnii in its sac are gradually absorbed and consequently the fetus is compressed and flattened by the pressure of the surviving twin. As death usually occurs about the fifth month or earlier, before ossification of the skeleton has taken place, the process of compression and flattening is easy. Such a fetus is known as "*fœtus compressus*" or *fœtus papyraceus*. *Fœtus compressus* may, however, also result from death of one of binovular twins and then it may occasionally happen that the dead fetus is expelled and the second continues to develop normally.

The Acardiac Monster. Occasionally one of uniovular twin fetuses may have no heart or only a rudiment of one. It is then known as the *fœtus acardiacus*, of which there are several varieties. For example, it may consist of a shapeless mass of connective tissue and bone with perhaps a rudimentary intestine and some traces of a spinal cord and covered by skin and hair—*fœtus acardiacus amorphus*, or there may be a head without a body—*fœtus acardiacus acornus*, or there may be a more or less well developed trunk without a head—*fœtus acardiacus acephalus*, or finally there may be a fairly well developed trunk with rudimentary extremities and a rudimentary heart—*fœtus acardiacus anceps*. These acardiac monsters may have their origin in a reversal of the circulation such as has been described above, but the modern view is that there is a primary defect in development. In any case it is obvious that the circulation in the acardiac fetus must be carried on by the heart of its fellow through the deep placental anastomoses.

Conjoined Twins. It will be recalled that if imperfect division of the embryos occurs after the formation of two embryonic areas, conjoined twins or double monsters result (p. 147). The degree and site of union vary almost infinitely, and consequently many different varieties of conjoined twins have been described, only the more common of which can be mentioned here. For a full account reference should be made to Ballantyne's '*Antenatal Pathology and Hygiene*,' where at least thirty varieties are

included. When the twins are united solely by the head the condition is known as *craniopagus*. If united by the thoracic and epigastric regions it is known as *thoracopagus*. To this category belong the famous Siamese twins. Less common is *pygopagus*, when the twins are joined at the pelvis, as in the Brighton twins, and *dicephalus*, where there is union of the pelvis and parts above, with separate heads and necks. In *ischiopagus* the axes of the two bodies are in the same straight line.

Feldman believes that not all conjoined twins are of uniovular origin, and points out that though human conjoined twins are always of the same sex, authentic cases have been reported of conjoined twins in other mammals in which the components belonged to opposite sexes. No observation has apparently ever been recorded on the blood groups of conjoined twins.¹

Influence of Age in the Causation of Multiple Pregnancy
Matthews Duncan found that the largest number of twins are produced by women from twenty five to twenty nine years of age, and that on each side of this "climax of fertility" the tendency to twinning gradually diminishes. He found also that the mean age of twin bearing mothers is greater than that of mothers generally, that twins increase in frequency as mothers become older, that newly married mothers are more liable to have twins the older they are, and, finally, that a woman is more likely to have twins in each succeeding pregnancy than in a former one.

Heredity in Twinning That there is a tendency to twinning on the part of certain families is a matter of common knowledge. Bunn relates the case of a woman who from eleven pregnancies produced thirty two children—three times twins, six times triplets, and twice quadruplets. The father was himself a twin and the mother one of quadruplets. Davenport states that the twin rate is increased four to seven times in twinning families. Kadjar found that in twenty seven binovular twin pregnancies there was a clear history of heredity twelve times, six times on the mother's side, four times on the father's side, and twice on both. Of sixteen uniovular twin pregnancies a history of heredity was only present in six, four times on the mother's side, and in two on that of the father.

That the father as well as the mother can be responsible for twinning is a matter of common knowledge. Peiper relates the case of a man whose wife invariably gave birth to twins. On his death she married again, and thereafter only had single births. The first husband was himself a twin. Then there is the oft quoted case of the Russian

¹ For a full discussion of this matter the reader is referred to an article by W. M. Feldman on "Fetal Diseases, Malformations and Monstrosities," in Rolleston's "Encyclopedia of Medical Practice."

peasant, Wasilef, who, twice married, had by his two wives eighty-seven children. The first had quadruplets four times, triplets seven times, and twins sixteen times. The second had triplets twice, and twins six times. Puech quotes the case of another Russian peasant, Karlow, presented to the Empress Catherine in 1753, who had by his two wives sixty-four children. His first wife had quadruplets four times, triplets seven times, and twins six times, the second triplets once, and twins six times. Puech relates, too, the case of a Parisian named Blunet whose wife had twenty-one children in seven successive pregnancies. One might doubt, 'says Puech, "which partner contributed to this result had not the husband seduced the servant maid, who at the end of nine months was delivered of triplets."

Davenport, however, has found more convincing evidence. Studying twinning fraternities that contained two or more twins he found that of the births giving rise to fraternities of twin repeating mothers 4.5 per cent are twin births. Of the births giving rise to fraternities of twin repeating fathers 4.2 per cent are twin births. The sisters of twin producing fathers have twins in 8.2 per cent of labours, while the sisters of twin producing mothers have twins in 5.5 per cent of labours. Among the children of brothers of twin producing fathers 6.5 per cent are twins. Among the brothers of twin producing mothers 4.5 per cent of the children are twins. These figures indicate that the twin ratio is increased four to seven times in twin producing families, and that the ratio of twin production is about as high on the father's as on the mother's side of a fraternity which contains two or more twins. This equality of paternal and maternal influence held good for both uniovular and binovular twins, and disposes of the statement that fathers play no rôle in twin production.

From what has been said (p. 148) regarding an inherent weakness of intercellular cohesion in the zygote it is not difficult to understand how either parent can be responsible for uniovular twinning. It is easy, too, to understand how the twinning tendency, where the twins are binovular, can be inherent in the mother through an inherited tendency to double ovulation (p. 147). As regards the paternal influence in binovular twinning, Davenport offers the following explanation. Not all the eggs that are ovulated at one ovulation are fertilised. There is evidence based on counts made of the corpora lutea of pregnant and non pregnant women that the rate of occurrence of two or three corpora lutea in the ovary is much greater than the incidence of twins. And of eggs that are fertilised a certain proportion are aborted at an early age and it is probable that the death of a large number of these embryos is due to some lethal factor in the sperm. The production of binovular twins would then be due to double ovulation combined with some other factor that induces a large proportion of such double ovulations to produce viable twins. This other factor is the capacity of the male to fertilise all the eggs ovulated with sperm which contains no lethal factor. This capacity for complete fertilisation, and the absence of lethal factors, are both hereditary characters in the male. Pathology, multiple pregnancy is regarded as evidence of an atavistic

tendency, and it is said that not infrequently other evidence of the reversion is found in the presence of accessory nipples double uterus etc

Superfecundation By this is meant the fertilisation of, and twin pregnancy resulting from, two ova derived from the same ovulation or from two ovulations taking place within a few days of each other, the fertilisation being brought about by sperms derived from coitus on different occasions Its occurrence in the lower animals is well authenticated, and is easily proved by the birth of young of different types at one time It has been experimentally produced in rabbits by successively mating an albino doe with an albino and a coloured buck within a few hours of each other Albinism being a recessive Mendelian character the existence of albino and coloured offspring in the resulting litter proves the possibility of superfecundation It is possible also in the human female as is shown by the birth of twins one of which is white and the other mulatto to a woman who cohabits successively with a white man and a negro Such instances have been recorded

Superfotation By this is meant the partly simultaneous development in the uterus of two or more foetuses derived from ova liberated at independent ovulations separated from each other by a considerable period of time, or in brief the superposition of one pregnancy on another Theoretically, it is possible so long as the membranes (*decidua capsularis*) of the first foetus have not come into contact with the uterine wall (*decidua vera*) It is therefore, not possible after the third month If it is true that menstruation can occur in the first three months there would seem to be no reason against it Of course, ovulation too, must occur, and Ribemont Dessaignes states that this has been observed in more than one woman dying during pregnancy He records two remarkable examples of superfotation One is the case of Dr Marianne Byaud, who on April 1st, 1748 delivered of a living viable child a woman who on September 17th of the same year, i.e., five months later, gave birth to an infant at term The other case was that of Benoitte Franquet who was confined on January 20th, 1780, of a girl apparently seven months and on July 6th of the same year, of another girl at term Foderl states that in exceptional cases superfotation may be mechanically possible until the end of the third month, and gives details of a case which supports his view, a four para, aged thirty four, expelled a fresh male embryo, 15 cm long, followed by a complete placenta Two days later, bleeding not having ceased, a

lump was removed from the uterus by operation, which was slightly larger than a walnut and was regarded as placenta, but was found to contain as well as placental substance, a fresh embryo, 16 mm long. From comparison of the two placentas and their membranes, and from the microscopical characters of the epidermis and viscera of the smaller foetus, it was demonstrated that its age was certainly less than two months, probably about six weeks, i.e., about eight or nine weeks younger than the foetus first expelled. Meyer, after reviewing the whole subject concludes, however, that most of the cases recorded are twin pregnancies in which one foetus died and was retained till the birth of the other. "At present," says Meyer, "*superfoetation remains merely a possibility, for the evidence on which it rests is wholly inadequate*" Studdiford considers that no proved case has ever been reported.

Triplets These may be derived (1) from three separate ova, (2) from two ova, one of which gives rise to uniovular twins (3) from one ovum which gives rise to uniovular triplets. Most often they are derived from two ova, while uniovular triplets are extremely rare. Ballantyne,¹ in 1902, could only find nine well authenticated cases recorded. As regards the membranes if the triplets are triovular, there may be three separate placentas, or more often, there are two, but always with three chorions. *If they are uniovular, there is a single placenta with one chorion, but separate amniotic sacs, the partition between the sacs consisting, as in uniovular twins, of two layers of amnion.* In binovular triplets there may be a single placenta with two chorions, or two separate placentas, one of them uniovular, with one chorion and two amniotic sacs.

Clinical Features of Multiple Pregnancy

As the abdomen is usually unduly enlarged, the diaphragm is pushed up more than in single pregnancy, the heart is further displaced, and the bases of the lungs more compressed, *and this leads to increased dyspnoea.* Partly on this account, partly because of the very large abdomen, there may be difficulty in walking. The over-distended uterus compresses the veins of the abdominal wall, and may lead to œdema of the abdominal wall, vulva, and lower extremities. The excessive movements of the foetuses may interfere with sleep.

¹ *Loc cit*

There is an increased incidence of pre eclamptic toxæmia. In single pregnancy its frequency is variously estimated at 4 to 14 per cent. In a series of fifty cases of twin pregnancy reported by McIlroy and Evans the pregnancy was normal in 22 per cent, in 46 per cent there was toxæmia and in 22 per cent there was toxæmia with hydramnios. Cho found that eclampsia occurred in 4.74 per cent of his 232 twin pregnancies. All the other manifestations of toxæmia are also more common, *e.g.*, hyperemesis (especially if there is acute hydramnios) ptyalism etc. There is a special liability to placenta prævia because of the large size of the placenta. Cho states that it occurred twice in his 232 cases (0.86 per cent). Labour comes on prematurely in about one third of the cases. The greater the number of fetuses the greater is the tendency to premature birth and this is more likely to occur in uniovular pregnancy, and especially if there is hydramnios. The cause of the prematurity is probably to be found in the over distension of the uterus including its lower segment. Hydramnios is frequent, especially in uniovular twins. Of seventy twin pregnancies observed by Kadjar ten had hydramnios three of these were binovular and seven uniovular. As binovular twins are three times as frequent as uniovular, it follows that uniovular twins are three times as liable to hydramnios as binovular twins are. The hydramnios may set in very early. Of fifteen examples in uniovular twins recorded by Wilson it set in before three months in three cases, and from three to four months in five. Possibly the hydramnios is connected in some way with the anastomoses between the placental circulations (p. 149).

Presentations. From various sources Leonhard has constructed the following table showing the presentation in 1,840 cases —

First Twin.	Second Twin	Number of Cases.	Percentage
Vertex	Vertex	709	38.53
Vertex	Breech	390	21.19
Breech	Vertex	264	14.35
Breech	Breech	198	10.76
Vertex	Transverse	153	8.32
Transverse	Vertex	16	0.87
Breech	Transverse	79	4.29
Transverse	Breech	14	0.77
Transverse	Transverse	17	0.92

is no doubt due chiefly to defective intra uterine calcification (which we have seen takes place mostly in the last two months of foetal life), so that the infant's calcium stores are low at birth, but partly also to deficiency in the stores of vitamin D, as the subcutaneous fat, which may be an important source of it, is almost entirely wanting. Anæmia, too is apt to develop because of the deficient stores of iron in the liver. These deficiencies may be present also in full time twin infants, for the mother's intake of calcium and phosphorus is generally very insufficient for the needs of the two foetuses. In the management of full time and, still more, of premature twin children, therefore, it is important to take measures to counteract these tendencies by giving cod liver oil and iron, and possibly by exposure to ultra violet rays from an early period though the congenital predisposition to rickets may be so great that even the best postnatal treatment may fail to prevent it. The special liability of premature infants to hypervitaminosis D should not be forgotten and care should be exercised in the administration of ultra violet light and preparations containing vitamin D, such as cod liver oil, caleiferol etc.

Left handedness is about six times as frequent among twins as in single children. The tendency is more marked in identical twins, of whom almost 50 per cent are left handed.

REFERENCES

- AMEL FELD *Archiv f Gynäk* 1872 2
 ARNOUX M E *Jour de Méd de Paris* 1908 20 393
 CAPPEN A *Amer J Dis Child* 1928 35 263
 CHŌ F *Jour Japanese Gyn Soc* (abstract number) 1934 XXIX 67
 DAVENPORT C B *Proc Soc Exper Biolog and Med* 1919 20 17 1504
 DUNCAN I MATTHEWS *Fdm Med Jour* 1864-5 10 767
 ENGELHORN F *Biologie u Path des Weibes* (Halban u Seitz) 1925-6 Bd VII, Teil I 335
 FELDMAN W M *Brit Med Jour* 1930 11 1113
 FÖDERL U *Archiv f Gynäk*, 1932, 148, 853
 KADJAR M R *La gynécologie* 1927 26 449
 McILROY A LOUISE and EVANS E C *Med Jour and Record New York*, 1927 126 359
 MEYER A W *Jour Im Med Assoc*, 1919 72 769
 NEWMAN H H *The Biology of Twins* Univ Chicago Press 1917
 NEWMAN, H H *The Physiology of Twinning* Univ Chicago Press 1923
 QUIGLEY, J K *Am Jour Obst and Gyn*, 1935 29 354
 RIBEMONT DESSAIGNES A and LEPAGE G *Précis d obstetrique* Paris, 1894
 SCHATZ F *Archiv f Gynäk* 1881 23 and 24 337
 STOCHARD C R *Am Jour Anat* 1921 28 116
 STODDIFORD W L *Am Jour Obst and Gyn* 1936 31 845
 TAKAHASHI K *Jour Japanese Gynec Soc*, 1934 29, 61

it into a transverse. If the fetus is transverse external cephalic or podalic version should be done. A breech delivery in this case is attended by little risk as the passages have been thoroughly dilated by the first child.

After expulsion of the first child there is usually a more or less prolonged pause during which pains entirely cease. The placenta or placentas nearly always come away only after the birth of the second child. Contractions usually start again in half an hour or so and the second child is delivered rapidly. If they do not start in an hour the membranes may be ruptured and $\frac{1}{2}$ c.c. of pituitary extract may be given and the fundus massaged. A special watch should be kept for post partum hæmorrhage, and it is wise to stay with the patient for a longer time than usual.

Prognosis. The maternal mortality in multiple pregnancy is high (4.09 per cent Strassman 4.4 per cent Takahashi). This is due to various causes—the increased length of labour leading to shock and exhaustion, the high incidence of the pregnancy toxæmias including both hyperemesis and eclampsia, and the increased liability to post partum hæmorrhage on account of the over-distended atonic condition of the uterus and the large placental site. For the child the outlook is also worse than in single pregnancy because of the risk of intra uterine death (either from causes connected with the placental circulation or from pregnancy toxæmia) of premature labour malpresentations prolapsed cord etc. In a series of 248 twin labours recorded by Takahashi 167 (33.7 per cent) of the children were either dead born or died in the first week. The second child may be endangered by the shrinkage of the uterus and the placental site after the first is born and possibly from premature separation of the placenta. According to Westergaard only a little over 50 per cent of twin boys survive the first five years as compared with 84 per cent of single boys, of twin girls a little over 66 per cent survive the first five years as compared with 87 per cent of single girls. The danger however is chiefly in the first two years and after that time it appears to be little greater than in single children. Of triplets only about one third survive the first year. This high mortality is due chiefly to prematurity, and the ailments to which premature infants are liable—intracranial hæmorrhages congenital debility respiratory and other infections malnutrition etc. Capper states that practically all premature infants develop rickets and that very early even in the first year of life. This

is no doubt due chiefly to defective intra uterine calcification (which we have seen takes place mostly in the last two months of foetal life) so that the infant's calcium stores are low at birth but partly also to deficiency in the stores of vitamin D, as the subcutaneous fat which may be an important source of it, is almost entirely wanting. Anæmia too is apt to develop because of the deficient stores of iron in the liver. These deficiencies may be present also in *full time* twin infants for the mother's intake of calcium and phosphorus is generally very insufficient for the needs of the two foetuses. In the management of *full time* and still more of premature twin children, therefore it is important to take measures to counteract these tendencies by giving cod liver oil and iron and possibly by exposure to ultra violet rays from an early period though the congenital predisposition to rickets may be so great that even the best postnatal treatment may fail to prevent it. The special liability of premature infants to hypervitaminosis D should not be forgotten and care should be exercised in the administration of ultra violet light and preparations containing vitamin D such as cod liver oil calciferol etc.

Left handedness is about six times as frequent among twins as in single children. The tendency is more marked in identical twins of whom almost 50 per cent are left handed.

REFERENCES

- WILFELD *Arch v f Gynäk* 1872 9
 ARNOUX M E *Jour de Méd de Paris* 1908 20 393
 CAPPER A *Amer J Dis Child* 1908 35 263
 CHŌ F *Jour Japanese Gyn Soc* (abstract number) 1934 XXIX 67
 DAVENPORT C B *Proc Soc Exper Biolog a d Med* 1919-20 17 1504
 DUNCAN J MATTHEWS Ed: *Med Jour* 1864-5 10 767
 LAGELHORN F *Biologie u Path des Weibes (Halban u Sehr)* 1905-6 Bd VII Teil 335
 FELDMAN W M *Brit Med Jour* 1930 ii 1113
 FIDEL U *Archiv f Gynäk* 1932 148 653
 KADJAR M K *La géologie* 1907 26 449
 McILROY A LOUISE a d EVANS E C *Med Jour a d Record New York* 1907 126 359
 MEYER A W *Jour Am Med Assoc* 1919 72 769
 NEWMAN H H *The Biology of Twins* Univ Chicago Press 1917
 NEWMAN H H *The Physiology of Twinning* Univ Chicago Press 1923
 QUIGLEY J K *Am Jour Obst a d Gyn* 1935 29 354
 RIBEMONT DESSAINES A and LEPAGE G *Précis d'obstetrique* Paris 1894
 SCHATZ F *Arch v f Gynäk* 1884 23 and 24 837
 STOCKHARD C R *Am Jour Anat* 1921 28 110
 STUDDIFORD W E *In Jour Obst and Gyn* 1936 31 845
 TAKAHASHI K *Jour Japanese Gynec Soc* 1934 29 61

CHAPTER VI

ABNORMALITIES IN THE QUANTITY OF AMNIOTIC FLUID

Hydramnios

THE normal amount of liquor amni is about one to three pints (1.2 litres). A quantity greater than 2 litres may therefore be regarded as excessive but the line of division between the normal and abnormal is necessarily somewhat arbitrary, and a better definition of hydramnios may therefore be 'an excess of liquor amni sufficient to cause abnormality in pregnancy or labour'. In its chemical composition the hydramniotic fluid does not differ from normal.

Ætiology. Our knowledge regarding the causes of hydramnios and indeed regarding the origin of the normal liquor amni, is scanty and incomplete. While it was formerly believed that the liquor was derived from the fetal or maternal circulation by a transudation through an indifferent membrane according to purely physical laws, the researches of Polano and others show that it is probably secreted by the amniotic epithelium in which granules, fat droplets and vacuoles have been observed. The weight of evidence favours the view that the normal liquor has both a maternal and a fetal origin, i.e., that it comes from the fetal blood vessels in the placenta and possibly in the cord and from the maternal blood in the placental sinuses. The following are the arguments in favour of each.

Arguments in Favour of a Maternal Origin. (1) Sodium indigo sulphate injected into the vein of a rabbit near term colours the liquor amni but not the fetal tissues or urine. This does not exclude a fetal origin in addition.

(2) Potassium iodide given to the mother by the mouth appears in the amniotic fluid but not in the fetal urine or blood.

(3) Methylene blue administered to the mother appears in the mother's urine and in that of the fetus and child. A colourless compound only occurs in the liquor amni. This suggests that the fetus does not normally micturate *in utero* and that therefore none of the liquor is derived from that source. The colourless compound found in the amniotic fluid has probably been secreted and altered by the amniotic epithelium.

(4) In 1872 Gussierow reported a case of *sulphuric acid poisoning*. The liquor amni gave a positive reaction for sulphuric acid but none was found in the fetus.

(5) Hydramnios is sometimes associated with disease in the mother. For example in heart disease with congestive failure very severe and acute hydramnios may occur, probably from stasis in the placental circulation.

It will be observed that none of the above observations exclude the foetal circulation in the placenta as an additional source of the fluid.

Arguments in Favour of a Foetal Origin (1) Chorio angioma of the placenta is often associated with hydramnios. This is a tumour of the placenta varying in size from a cherry to a full term foetal head. There are about 150 recorded cases and in the 110 about which data have been collected by Siddall there was hydramnios in 36 (32·7 per cent) and the hydramnios was much more frequent in connection with the large than with the small tumours. Kraus found it in a still larger proportion of cases i.e., 9 out of 14. Now, the chorio-angioma is derived from a single villus the vessels and connective tissue of which have undergone enormous hyperplasia. The tumour is surrounded by a pseudo capsule composed of fibrin and compressed degenerate villi. The blood in the tumour is therefore entirely foetal. As the tumour is usually found only beneath the amniotic surface of the placenta it could not in any way cause stasis in the maternal circulation and the hydramnios must have its origin in the foetal blood in the tumour.

(2) The very frequent association between hydramnios and anencephaly has been explained by the assumption that there is a transudation of fluid from the exposed meninges or choroid plexus. The normal foetus too swallows liquor amni as is evidenced by the finding of lanugo hairs in the intestine. In the anencephalic foetus the power of swallowing is said to be absent. Taussig examined the intestinal contents of two anencephalic foetuses and failed to find lanugo hairs in either. Also congenital closure of the oesophagus is liable to be associated with hydramnios. It may therefore be that in both these cases the failure to swallow liquor partly accounts for its excess.

(3) Hydramnios often accompanies general dropsy of the foetus. In this condition the mother is usually healthy and the dropsical condition which affects both foetus and placenta is probably due to failure on the part of the blood forming organs with resulting acute anaemia. The hydramnios may be explained in the same way as the ascites and other effusions into the foetal serous cavities.

It is often stated that hydramnios is due to foetal polyuria but there is no real evidence in favour of this view. Indeed all the evidence is against it. It has been already mentioned that methylene blue administered to the mother does not stain the liquor though present in the foetal urine. If phloridzin is injected into the mother sugar appears in the foetal urine, but not in the liquor amni. Finally in cases of complete absence of both foetal kidneys or of complete closure of the urethra the amount of liquor is usually normal as in the case reported recently by Gower.

On the whole therefore the evidence is in favour of the view that the liquor amni is normally derived from both the foetal and maternal placental circulations and in accordance with this view an attempt may be made to classify the causes of hydramnios.

Maternal Causes (1) *Heart disease with severe congestive failure*

and œdema Here the cause of the hydramnios is probably stasis in the maternal circulation in the placenta

(2) *Diabetes* is sometimes associated with hydramnios It is probable that the sugar in the amniotic fluid stimulates the amniotic epithelium so that a larger amount of fluid is secreted

(3) *Pre eclamptic toxæmia* is often associated with excess of liquor amnii A possible explanation is the vascular hypertension in the mother Toxæmia without any other known cause was present in three out of Taussig's 32 cases, and in two of these there was hypertension

(4) *Multiparity* It is said that 75 per cent of the cases occur in multiparæ It is possible that the laxity of the abdominal walls and diminished tone in the uterus are predisposing factors

Paternal Causes McFeeters has recently suggested that hydramnios is sometimes hereditary He reports its occurrence in three members of one family and is of opinion that it may be transmitted through the male parent

Fœtal Causes (1) *Chorio amnionitis* of the placenta This has been previously discussed (p 154)

(2) *Syphilis* It is generally held that syphilis is a predisposing cause though it is denied by some writers Cirrhosis of the fœtal liver or partial closure of the umbilical vein might cause it through stasis in the fœtal circulation in the placenta

(3) *Fœtal deformities* The frequent association between abnormalities of the fœtus and hydramnios is well known by far the most common abnormality encountered being anencephaly It is probable that the hydramnios in this case is explained partly by transudation of fluid from the exposed meninges and choroid plexus and partly by absence of the power of swallowing As illustrating the importance of the latter may be mentioned a not infrequent association of congenital closure of the œsophagus with hydramnios Apparently, if the closure affects the small intestine no hydramnios occurs as enough fluid may still be absorbed by the stomach to permit an outflow by the fœtal circulation

(4) *Multiple Pregnancy* It is doubtful whether hydramnios occurs in binovular twin pregnancy, but its frequent association with uniovular twins is well established and the frequency of uniovular twin pregnancy in hydramnios is estimated by Taussig as from 10 to 20 per cent It is by far the most frequent cause of the acute form of hydramnios It does not occur however, in

every case of uniovular pregnancy, thus Van Santer states that in eight cases of uniovular triplet pregnancy there were only two complicated by hydramnios, and neither was acute. When it does occur the excess of fluid is confined to one sac, and in some cases the fluid in the other sac may be scanty. Regarding the mode of production of the hydramnios in these cases we know nothing. As the placental circulations communicate with each other (p 148) it is probable that the cause lies there. Not any of the explanations that have been advanced is satisfactory, but the following theory is the least objectionable. It is said that the hydramnios affects the sac of the larger foetus. If for some reason one foetus gets more than its share of circulating blood, its heart and kidneys hypertrophy, with the result that the secretion of urine is greatly increased and hydramnios ensues. Apart from the fact that there is not any evidence that foetal urine enters into the formation of the liquor amni to any appreciable extent, such an explanation would fail completely to account for the occurrence of acute hydramnios, in which the fluid often reaches an enormous amount in a few days, at an early period of pregnancy, when the secretion of foetal urine must be very scanty, if it occurs at all.

(5) *General dropsy of the foetus* has been already discussed (p 164).

(6) *Large size of the foetus* and especially of the *placenta* has been invoked as a cause, but information on this point is uncertain. Finally, in about 25 per cent of cases no cause whatever can be discovered. According to Taussig neither the liquor amni nor the amniotic epithelium show any abnormal characters.

Varieties of Hydramnios. There are four distinct varieties.

(1) *Acute Hydramnios.* This is very rare—so much so that every case should be reported. Chambrelent, in 1917, found only fifty cases in the literature. The fluid increases rapidly from the start, so that in a few days the uterus becomes distended to such an extent as to cause serious distress. According to Plauchu acute hydramnios in the early months is almost diagnostic of uniovular multiple pregnancy. The prognosis for the foetus is extremely bad, as the pregnancy almost always ends before the stage of viability.

(2) *Chronic Hydramnios.* This more commonly makes its appearance in the later months. The fluid gathers slowly, and therefore rarely gives rise to any marked distress, though the large abdomen may cause difficulty in walking.

(3) *Subacute Hydramnios.* The term explains itself.

(4) *Chronic Hydramnios* becoming afterwards acute.

Clinical Features *In the Acute form* the fluid accumulates rapidly giving rise to more or less marked distension of the abdomen by a mid line symmetrical swelling. There may be considerable oedema of the feet and legs, and less frequently of the labia probably from pressure on the larger veins of the pelvis. Especially when the hydramnios occurs early in pregnancy hyperemesis may be an outstanding feature. As the fluid continues to accumulate there may be pain in the lower part of the abdomen and over the sacrum, great dyspnoea from pressure on the thorax and displacement of the heart, rapid pulse and palpitation on slight exertion and if not relieved the condition may even be fatal at this stage. The abdomen is tense and tender, and there is a fluid thrill but no fetal parts can usually be felt, nor can foetal heart sounds be heard. Intermittent uterine contractions can however generally be made out and a uterine souffle—of great diagnostic importance—can often be heard. It may be possible especially if the pregnancy is advanced, to elicit external ballotement. On vaginal examination in addition to the usual signs of pregnancy in vagina and cervix, an attempt should be made to elicit internal ballotement. The cervix is pulled up by the distension of the uterus—an important point in differentiating from an ovarian cyst. An X ray examination will generally yield important evidence, though in acute hydramnios the plate is liable to be fogged. Finally, as acute hydramnios may develop at a very early stage, the Zondek Aschheim test may be necessary to determine whether the patient is pregnant or not.

Time of Appearance of Hydramnios It rarely causes trouble before the 18th week. The earliest cases are those setting in rapidly in uniovular twin or triplet pregnancy. The earliest case in the author's experience was in a uniovular twin pregnancy at eighteen weeks, and Balfour Marshall reported a case at the same time. The chronic variety more often begins in the later months. Taussig and others believe that hydramnios often occurs in the early ovum, possibly in association with malformation of the embryo, and brings forward in support of his contention the observation that in tuberos mole the amniotic sac is often extremely large compared with the minute embryo therein. He believes, too, that the hydramnios is responsible for the formation of the tuberos mole in the following way. When the embryo dies the amniotic fluid is rapidly absorbed. The amnion thus collapses and becomes folded on itself, while at the same time the maternal circulation continues. In the end the circulation gradually ceases and the maternal blood, clotting in the intervillous spaces behind the amnion, gives rise to the characteristic appearance of the tuberos mole.

Diagnosis As a rule the diagnosis of hydramnios presents no difficulty. Difficulty may, however, arise in the acute and sub acute forms, especially as they may be met with at such an early stage of pregnancy that none of the absolute signs of pregnancy can be made out. In such cases X rays and the Zondek Aschheim test should be called into requisition. The following conditions may require to be differentiated.

(1) *Ovarian Cyst* This, apart from pregnancy, does not give rise to amenorrhœa. The fluid accumulates less rapidly in a cyst. Careful examination in hydramnios will generally elicit intermittent uterine contractions, and, most important of all, on account of the distension of the uterus and its intimate contact with the abdominal wall, a uterine souffle can usually be heard. A useful sign described by H. R. Spencer is as follows.—Turn the patient on to the knee elbow position. The foetus falls downwards against the abdominal wall and can be felt or ballotted there. On vaginal examination the cervix is felt to be pushed down by an ovarian cyst, but in hydramnios the distension of the uterus has pulled the cervix up and rendered it inaccessible.

(2) *Ovarian Cyst with Pregnancy* Here it may be possible to feel the sulcus between the cyst and the uterus, and the fetal limbs may be felt at one side of the abdomen, the other side being occupied by the cyst. One side of the abdominal swelling may be

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Chronic Hydramnios usually appears in the later months. As the fluid accumulates gradually the abdominal and thoracic organs have time to accommodate themselves to the increase and so the only signs of distress may be slight dyspnoea especially on lying flat and difficulty in getting about on account of the large pendulous abdomen. There is often albuminuria and more or less rise of blood pressure and sometimes on account of the pressure of the large uterus on the pelvic veins and those of the abdominal wall there is œdema of the lower extremities and labia or this may be a manifestation of pre eclamptic toxæmia. On abdominal examination the foetal parts can usually be palpated but on account of the tenseness of the abdomen it may be impossible to be sure of the presentation and position. Mal presentations are common and in vertex cases the head is often not engaged in the pelvis even at term.

lines If there is difficulty in getting about, a well fitting binder helps to support the large abdomen

In the acute form the distress is so great and the symptoms so urgent that there is usually no question of expectant treatment As soon as the diagnosis is made labour should be induced by high puncture of the membranes The method of doing this is described on p 283

Puncture of the amniotic sac through the abdominal wall and withdrawal of liquor by means of a trocar and canula, as practised by Wormser and later by Henkel and by Rivett in this country, has sometimes been successful in relieving distress and enabling the pregnancy to continue The relief is apt to be temporary and besides malformations are so frequent that the life of the fœtus, and therefore the continuance of the pregnancy is less important than usual If, however, X ray examination fails to show any foetal abnormality, there can be no objection to trying it The only risk appears to be that in about half the cases the patient goes into labour As much as 5 pints or more may be withdrawn according to the degree of hydramnios and at one or more sittings Rivett points out that even in acute hydramnios the liquor amni does not appear to be under pressure and has to be sucked out with an aspirating syringe

Complications during Labour Malpresentations may necessitate correction by external version followed by immediate rupture of the membranes in order to fix the presenting part in its new position All stages of labour are liable to be slow on account of the over distension of the uterus and there is greatly increased danger of post partum hæmorrhage for the same reason When labour sets in it is often advisable to puncture the membranes early, and so relieve the distension and distress A tight binder coming well up over the fundus should be applied to push the presenting part into the pelvis and help contractions Measures should be taken to guard against post partum hæmorrhage and to deal with it effectively should it arise

Habitual Hydramnios It is rare for hydramnios to reappear in successive pregnancies A remarkable case has however, been reported by Luttger The first two pregnancies were normal, and the children alive and well The third complicated by hydramnios, ended at seven months, and the child lived an hour In the fourth there was also hydramnios it ended at eight months and the child again lived an hour The fifth was born

found to undergo intermittent contractions, and the other to remain stationary. The abdomen is usually larger than it should be for the period of amenorrhœa.

(3) *Retroverted Gravid Uterus with Distended Bladder* The abdominal swelling here sets in about the 14th week and therefore rather earlier than even acute hydramnios. General considerations, especially the position of the cervix (p. 293), overflow incontinence and the passage of a catheter, will easily make the diagnosis clear.

(4) *Multiple Pregnancy* The enlargement here is obviously not due to excess of fluid, and there is no undue mobility of the foetal parts.

(5) *Ascites* Signs of pregnancy are absent, but instead there is other evidence of heart, liver, or kidney disease. There is shifting dullness and if the quantity of free fluid is small the dullness is confined to the flanks.

(6) *Fatal Ascites* In this condition there is great distension of the abdomen of the foetus with dropsical fluid. It is often associated with hydramnios. In foetal ascites the foetus is less mobile than in hydramnios.

Complications of Pregnancy associated with Hydramnios The association of hydramnios and pre-eclamptic toxæmia has been referred to above (p. 162). Nothing certain is known as to the cause of this. Of Burstall's 69 cases it was found in 41 per cent. Diabetes is not uncommon in association with the chronic or sub-acute forms and Poeck in 103 cases found syphilis in fourteen. Malpresentations are very frequent on account of the undue mobility of the foetus and the over-distension of the uterus. Poeck found a transverse lie eleven times in 136 cases, and a breech presentation twenty times. Non-engagement of the head in the pelvic brim in primigravidae in the last month of pregnancy is a common consequence, and, finally, there is a tendency to premature labour. The cases of acute hydramnios early in pregnancy with uniovular twins almost always end in abortion.

Management of the Pregnancy In the chronic and sub-acute forms any causal condition suspected should be treated such as syphilis, diabetes, etc. It is often advised that the patient should limit her intake of fluid and wear a tight binder. In some cases these measures seem to be effective and as they do no harm they may always be tried. Toxæmia should be treated along the usual

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ing its aetiology. Two theories may be mentioned, neither of which satisfactorily explains it.

(1) That there is degeneration or actual necrosis of the amniotic epithelium, which is generally considered to have normally a secretory action. Normally, the epithelium consists of two layers, a tall columnar layer which is actively secretory and a low cuboidal non secretory layer. It is held that absence of the secretory columnar layer over large areas may lead to oligohydramnios, or that, even though the layer is present it may be so altered by toxic or other causes, such as inflammatory changes in the placenta, that its secretory function is diminished or abolished, though the actual changes in the cell may be ultra microscopic. It has, however, been shown that normally the epithelium shows much variety in structure in different areas of the same placenta, and it would appear that these normal variations have not been sufficiently allowed for. The whole subject needs further investigation.

(2) That the oligohydramnios is due to atresia of the urinary tract or absence of the kidneys, whereby the foetus is prevented from contributing to the amniotic fluid by urination. According to Schuller, of fifty seven cases of oligohydramnios reported up to 1927, there were fifteen in which there was malformation of the urinary tract. *But there are numerous cases recorded in which there was complete absence of both kidneys, or atresia of the urethra, with normal quantities of liquoramni or even hydramnios.* Accurate observations and reports of such cases are badly needed. All one can say at present is that the probability appears to be that the oligohydramnios and the defect in the urinary tract are both due to changes in the germ plasm.

Effect on the Foetus. Besides various malformations, which are probably co-ordinated defects, due to the same cause as produced the oligohydramnios, the foetus is especially liable to pressure changes, such as club feet, curving of the lower extremities to correspond with the contour of the uterus, spinal curvature, etc. These changes are the result of the lack of liquor, allowing injurious pressure by the uterus on the foetus.

Clinical Features. The condition is said to be more frequent in primigravidae, and this may be correlated with the greater frequency of hydramnios in the multipara (p. 162). The uterus is often smaller than one would expect for the period of pregnancy, and the foetus is very immobile. According to Taussig breech

dead and macerated. The sixth pregnancy was normal and the child alive and well. The seventh was normal but the child only lived four hours. In the eighth there was slight hydramnios and the child was born dead at eight months. Besides these there were four abortions. The ninth and tenth pregnancies were again complicated by hydramnios and the fetuses were born dead and macerated at eight and nine months respectively. Luttger states that syphilis was excluded and it is true spirochetes were not found but in view of the fact that the placentas from the last two births were five ninths of the foetal body weights (p. 500) it seems at least suspicious.

Fate of the Child in Hydramnios. Malformations such as anencephaly (far the most frequent) hydrocephalus hare lip and cleft palate or congenital closure of the oesophagus are common. Poeck in 1903 studied the fate of 136 children from 103 cases of hydramnios occurring in the Frauenklinik at Königsberg from 1900 to 1900 with the following result. Eighty were dead born or died shortly after birth (59.6 per cent) and thirty six (40.4 per cent) were alive and normal. Krichula gives a much worse prognosis. He followed up as far as possible 991 children from 215 cases of hydramnios and found that 179 were either dead born or died shortly after birth. Of the remainder only eleven (3.78 per cent) were actually known to be alive and only three of them were normal. It must however be noted that 101 could not be traced at all. Floris gives an account of the results of 224 hydramniotic pregnancies. There were 206 children resulting. Of these forty nine were dead born, twenty four died after birth and 183 left hospital alive, ninety five of these being premature. Of these 183 he traced sixty five and found that only seven (10 per cent) had died. Of the sixty five he was able to examine thirty nine and found them physically and mentally up to the normal standard. Floris therefore concludes that the outlook is as good for the child resulting from a hydramniotic as from a normal pregnancy provided it is born free from severe deformity.

Oligohydramnios

In this condition which is much rarer than hydramnios the liquor amni is deficient. Any quantity less than one pint may be regarded as unduly small.

Ætiology. As in the case of hydramnios little is known regard

ing its aetiology Two theories may be mentioned neither of which satisfactorily explains it

(1) That there is degeneration or actual necrosis of the amniotic epithelium which is generally considered to have normally a secretory action Normally the epithelium consists of two layers a tall columnar layer which is actively secretory and a low cuboidal non secretory layer It is held that absence of the secretory columnar layer over large areas may lead to oligohydramnios or that even though the layer is present it may be so altered by toxic or other causes such as inflammatory changes in the placenta that its secretory function is diminished or abolished though the actual changes in the cell may be ultra microscopic It has however been shown that normally the epithelium shows much variety in structure in different areas of the same placenta and it would appear that these normal variations have not been sufficiently allowed for The whole subject needs further investigation

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Effect on the Foetus Besides various malformations which are probably co-ordinated defects due to the same cause as produced the oligohydramnios the foetus is especially liable to pressure changes such as club feet curving of the lower extremities to correspond with the contour of the uterus spinal curvature etc These changes are the result of the lack of liquor allowing injurious pressure by the uterus on the foetus

Clinical Features The condition is said to be more frequent in primigravidae and this may be correlated with the greater frequency of hydramnios in the multipara (p 162) The uterus is often smaller than one would expect for the period of pregnancy and the foetus is very immobile According to Taussig breech

presentation is common, as the foetus can in that position best adapt itself to the shape of the uterus. Correction of the faulty presentation will, of course, be impossible. In labour there is no bag of fore waters, and hence dilatation is likely to be slow, with frequent necessity for manual or instrumental interference and a high foetal mortality.

Treatment. In pregnancy no treatment is called for. In labour the management should be along similar lines to those followed in premature rupture of membranes, *i.e.*, watchful expectancy, with avoidance of interference until indicated by maternal or foetal distress. Should delivery be necessary before the cervix is fully dilated, dilatation may be completed manually, or if it is thinned out over the presenting part it may be divided by scissors postero laterally on both sides.

REFERENCES

- BURSTAL E *Practitioner*, 1910, 85, 112
 CHAMBRELENT J *Bull Soc d'obst et de gynéc de Paris*, 1914, 3, 432
 FLORIS M *Monats f Geb u Gynak*, 1923, 62, 55
 GOWAR F J SAMBROOK *Jour Obst and Gyn Brit Emp*, 1933, 42, 871
 GUNSELOW *Archiv f Gynak*, 1872, Bd 3 and 4, 241
 HENKEL M *Zent f Gynak*, 1919, 43, 841
 KRAHULA G *Monats f Geb u Gynak*, 1921, 55, 199
 KRAUS E *Zeits f Geb u Gynak*, 1903, 1, 53
 LÜTTGER, H *Monats f Geb u Gyn*, 1922, 59, 35
 MARSHALL G B *Jour Obst and Gyn Brit Emp*, 1914, 25, 201
 McFETERS J W *Brit Med Jour*, 1939, 1, 218
 PLALCHU *Lyon Medical* 1908, 110, 637
 POECK E *Monats f Geb u Gynak*, 1923, 63, 203
 POLANO O *Cent f Geb u Gynak*, 1905, 29, 1203
 RIVETT L CARNAC *Jour Obst and Gyn Brit Emp*, 1933, 40, 522
 SCHILLER W and TOLL, R M. *Am Jour Obst and Gyn*, 1927, 13, 689
 SIDDALL R S *Am Jour Obst and Gyn*, 1924, 8, 534
 SPENCER H R *Trans Lond Obst Soc*, 1899, 41, 273
 STRACHAN G I *Jour Obst and Gyn Brit Emp*, 1923, 30, 433
 TAUSSIG F J *Am Jour Obst and Gyn*, 1927, 14, 505
 WORMSER E *Zent f Gynak* 1920, 44, 137

CHAPTER XII

HÆMORRHAGE IN EARLY PREGNANCY

HÆMORRHAGE in early pregnancy may be due to one of the following causes —

Abortion threatened inevitable or incomplete

Disturbed tubal gestation (including tubal abortion and ruptured tubal gestation)

Hydatidiform mole

Mucous or fibroid polyp

Cervicitis with erosion of the cervix

Cancer of the cervix.

Abortion

Abortion is most likely to occur before the middle of the third month. This is partly accounted for by the mode of attachment of the placenta up to that time. Before the middle of the third month its attachment is entirely cellular the tips of the anchoring villi being fixed to the decidua by columns of Langhans cells (Fig 26). After that time the villi themselves have penetrated the decidua deeply so that the union is much firmer and stronger (Fig 27). On this account too abortion before the middle of the third month tends to be complete the entire placenta coming away with the fœtus while after that time it tends to be incomplete. Another reason given for the high incidence of abortion at this time is that the corpus luteum towards the end of the second month is failing and with it the supply of progesterin while the placenta has not yet fully taken over its function of progesterin production. There is thus a critical phase somewhere between the sixtieth and eightieth days when the supply of progesterin may be insufficient for the maintenance of pregnancy.

Diagnosis between Threatened and Inevitable Abortion In either there may be strong pains and severe bleeding and the presence of either of these does not necessarily make an abortion inevitable. An abortion is inevitable only if some part of the ovum is protruding into the cervical canal. The diagnosis between threatened and inevitable abortion can therefore be made only by vaginal examination, which should be carried out in every case but only with strict aseptic and antiseptic precautions.

The bowels should be regulated by a mild aperient liquid paraffin two tablespoonfuls night and morning being one of the safest. Enemas should be avoided.

Treatment of Inevitable Abortion Rest in bed is again essential. Liquid extract of ergot in half-drachm doses should be given three times daily for not more than four days. In addition pituitary extract may be given hypodermically or intramuscularly in doses of $\frac{1}{2}$ c.c. every two hours or at least as often as is convenient until six doses have been given. With this treatment



FIG. 27. Attachment of placenta to wall of uterus from tenth week on wards. The anchoring villi have grown into the decidua.

the uterus usually empties itself quickly and completely. It may, however, be necessary to empty it artificially (a) if there is dangerous bleeding (b) if the ovum does not come away in a reasonable time say a week or ten days. The method of doing this is fully described under septic abortion (p. 174).

Treatment of Incomplete Abortion The treatment is similar to that of inevitable abortion namely bed, ergot and pituitary extract. Most cases complete themselves in a few days at most. Interference is called for in the same conditions as in inevitable abortion and the method of emptying the uterus is the same.

Treatment of Septic Abortion Unless proved otherwise every

and the pouch of Douglas may be gently palpated, and any swellings or tenderness noted. Food is regulated largely by the patient's wishes, but should be nourishing and easily assimilated. Abundant fluids should be given and the bowels kept acting freely. If the temperature is high tepid sponging may be necessary. If there is much lower abdominal pain (always an indication of peri uterine inflammation) ice bags or anti phlogistine should be applied to the hypogastrium. *No vaginal douches should be given.*

In all but the mildest cases M & B 693 should be given by the mouth in doses of 1.5 grams three times daily.

Pituitary extract is useful to make the uterus contract and expel its contents, $\frac{1}{2}$ c.c. being given every two hours for six doses, and liquid extract of ergot may be given by the mouth in doses of half a drachm three times daily, but not for more than four or five days on account of the danger of causing gangrene of the extremities. By these means the uterus usually empties itself within a day or two.

There may be no need to explore the uterus at all but should there be any reason, such as persistent slight hæmorrhage, to think that it still contains some placental remains it may be lightly curetted, and the interior swabbed out with 10 per cent tincture of iodine. *This, however, should not be done unless the temperature and pulse have been normal for at least five days and there are no signs of peri uterine inflammation, chief among which are abdominal pain and tenderness.* Finally if anæmia is at all marked Bland's pills or ammoniated citrate of iron should be prescribed.

The Use of Glycerine. Some authorities advocate the injection of glycerine into the interior of the uterus as recommended by Remington Hobbs. It is said to produce a flow of bactericidal lymph into the interior of the uterus, but it is probable that the chief benefit is obtained from the drainage of the uterus by the introduction of the catheter. There is no objection to its use except the slight trauma and movement of the patient involved, but in experienced hands these need not be very serious. If it is decided to use it the patient is best put in the lithotomy posture.

cent. In the less serious group the mortality was 2.1 per cent. and 1.6 per cent. respectively. Dubrowitsch during the years 1912 to 1923 treated 445 cases. In 265 the treatment was active the uterus being cleared out in the feverish stage and the mortality was 2.26 per cent. In the remaining 180 the uterus was cleared out one to six days after the fever had subsided and in this group the mortality was 1.1 per cent. Speaking generally then it may be said that with active treatment mortality is about twice as high as with expectant methods.

mortality was 30 per cent, of seventy-three cases with non hæmolytic streptococci the mortality was 16 per cent.; of thirty-nine with staphylococci the mortality was 8 per cent, and of 211 with only saprophytic organisms the mortality was 2 per cent.

The cervix must be sufficiently open to allow the insertion of the index finger, and should it not do so it must be seized with a volsella or a ring forceps and gently dilated with graduated metal dilators. This should be done slowly and without using force, in order to avoid tearing the cervix, an accident that adds very materially to the risk of the operation. Statistics show that the mortality is twice as high if the cervix has to be artificially dilated, but sometimes this cannot be avoided.

Having thus dilated the cervix, the index finger is passed into the uterus, and the ovum, or the remains of it, carefully separated. Meanwhile the fundus is pressed down by the external hand so that every part of the interior of the uterus can be reached by the exploring finger. In doing so it is important to squeeze the uterus as little as possible. To explore the uterus easily, it is usually necessary to get the half hand into the vagina, and this may be difficult if the vagina is narrow. It is a good plan to iron out the vagina as advocated by Potter, of Buffalo. Using plenty of lubricant, which is preferably poured into the vagina while the labia are held apart, two fingers are placed in the posterior fornix, and the posterior vaginal wall ironed out by bringing the fingers downwards with a firm stroking movement to the vulva. Three and four fingers are thus successively used, and finally the half hand can be easily inserted. Patience and plenty of lubricant are the secrets of success in this procedure.

When the placenta has been separated it should be drawn out by an ovum forceps, and an intra uterine douche given. The interior is again explored to make sure that everything has been removed, and in doing so it should not be forgotten that the placental site is normally somewhat raised and uneven. A final intra uterine douche is now given. If hæmorrhage is troublesome the douche fluid should be at a temperature of 120° in the douche can, or 118° when it reaches the uterus. If, as usually happens, there is little bleeding, the temperature of the douche matters little, and 110° or thereabouts will suffice. In giving an intra uterine douche it is important to remember that there is some danger of forcing fluid, and with it septic matter, into the peritoneal cavity. To avoid this a two way cannula should

no constitutional disturbances in the mother as a result of intra uterine death. After a few days have elapsed, by which time the softening of the brain has allowed the skull to collapse overriding of the skull bones can be seen by X rays (Spalding's sign Fig 71 p 543). This sign is, of course of no value if the patient is in labour.

Treatment As a rule no treatment is required, as the uterus evacuates its contents in a week or two, and the patient can be assured that this will take place in due course without any interference. Maceration is an aseptic process, not attended by any constitutional disturbance, and, as the cessation of the placental circulation has led to thrombosis in the veins at the placental site there is no danger of bleeding. Labour should never be induced in these cases by rupture of the membranes, as the dead foetus may still be retained for some days, and is then very liable to become infected, especially by organisms of the gas forming type. If the patient wishes the uterus emptied in spite of reassurance this may be easily done up to the end of the fourth month by inserting a sponge tent in the cervix, and after twelve hours or so dilating the cervix by graduated dilators until the finger can be inserted, when the ovum is separated all around from its attachments, and drawn out by an ovum forceps. The technique is described under septic abortion (p 173). After the fourth month labour may be induced by bougies. Leyland Robinson, Datnow and Jeffcoate have obtained good results from the use of oestrin in cases of missed abortion. In 10 out of 12 cases evacuation of the uterus was brought about weeks or months after foetal death by injection of oestroform or dimenformone (Organon Laboratories). The amount given varied from 40,000 to 3,200,000 international units (100,000 i.u. per c.c.) and the number of injections varied from one to sixteen. The method has the great advantage that no mechanical interference is required.

Habitual Abortion (See p 198)

REFERENCES

- DIETRICH A H *Archiv f Gyn* 1923 120 14
 DEBROWITZKY I *Zent f Gynak* 1923 47, 1727
 HOBBS J REMINGTON *Brit Med Jour* 1927, ii 1223
 HORNER D A *Amer Jour Obst and Gyn* 1930 32 60
 POTTLE IRVING W *The Place of Version in Obstetrics* 1922 C V
 Mosby Co St Louis
 ROBINSON, A LEYLAND DATNOW M M and JEFFCOATE T N A *Brit Med Jour* 1935 i, 740
 WINTER G *Zent f Gynak* 1911 35 561
 WINTER G *Arch f Gynak* 1923 120 17

always be used and the douche can should not be raised more than a foot or two above the pelvis. It is usually advisable to pack the vagina with dry sterile gauze. It is scarcely ever necessary to pack the uterus but it might be called for if bleeding were excessive. The pack is removed the morning after the operation, and a vaginal douche given to remove any clots. Towards the end of the operation the pituitary extract is injected and it is a good plan to give ergot for three or four days afterwards. A rather severe pyrexia or even a rigor, often follows this operation, but in most cases the temperature and pulse become normal in a few days.

It must be emphasised that in *septic abortion this procedure is to be reserved for cases in which there is dangerous bleeding*.

Missed Abortion By "missed abortion" we mean that the foetus has died but has been retained, which it may be for weeks or months. When the foetus dies the uterus ceases to enlarge, and after a time even gets smaller, as the foetus shrinks and the liquor amni is gradually absorbed. The breasts get smaller, and the patient usually notices that they seem less full. After a time there is often a dirty brown discharge from the uterus which is probably due to retroplacental blood clot coming away. The Zondek Aschheim or Friedman tests may be positive for a week or more as the chorionic epithelium on which they depend remains alive for some time after the foetus has died. The disappearance of pregnandiol from the urine almost invariably means that the foetus is dead but its absence must be confirmed by two or more tests. As the progesterone of which pregnandiol is the excretion product comes from the placenta from the end of the third month onwards and as the placenta lives for some time after the foetus dies the pregnandiol may take some days to disappear from the urine after this has occurred. Before the third month its disappearance will also be gradual as the maintenance of the corpus luteum depends on the gonadotropic hormone produced by the placenta. If the pregnancy has progressed beyond the period of quickening the mother may notice that *fœtal movements have ceased*. This is usually the first sign noticed by her though sometimes on the other hand, she maintains that she feels movements when the foetus is known to be dead. The fœtal heart sounds will no longer be heard and Horner refers to a peculiar indescribable silence that he says is present—an 'audible silence'. Unless infection occurs which is very rare if the membranes are intact there are

the outer end of the tube. The blood gravitates into the pouch of Douglas, and there in course of time coagulates, acquires a capsule of lymph and a roof of adherent omentum and intestine, and forms a pelvic hæmatocele. Occasionally the blood may collect, not in the pouch of Douglas but between the uterus and bladder. Life is not usually, in such cases, in immediate danger unless hæmorrhage continues or recurs, in course of time the blood is entirely absorbed, leaving perhaps a few adhesions and a more or less damaged tube. Rarely, the hæmatocele may become infected and form an intra peritoneal pelvic abscess, which runs the usual course and may eventually evacuate itself through the vagina or elsewhere.

If, on the other hand, rupture of the pregnant tube occurs into the peritoneal cavity, as may happen, especially if the pregnancy is in the isthmial part of the tube the intra peritoneal bleeding may be profuse, and in the most serious cases almost immediately fatal. The signs are then usually characteristic. There is sudden onset of severe abdominal pain, meteorism, vomiting, faintness and collapse. All the signs of severe internal hæmorrhage are present. Occasionally "shoulder pain" is complained of in one or both shoulders. This is due to irritation of the endings of the phrenic nerve in the diaphragm referred to the distribution of the supra scapular nerve as this nerve and the phrenic both arise from the same (5th cervical) nerve root. This pain when present, however, is not pathognomonic, as it may be found also in appendicitis and in cholelithiasis. In other cases when the blood is limited to the pelvis, the pain may be referred, not to the shoulder, but to the back between the scapulae, to the epigastrium, or to the hypochondrium, where it may be so severe as to simulate renal colic. In diffuse intra peritoneal hæmorrhage the abdomen is usually distended (meteorism) and tender, with flank dullness, but fluctuation is usually absent on account of the coagulation of the blood.

If a pelvic hæmatocele has formed there may be a prominent mid line subtympantic swelling reaching from the pubes upwards towards the navel or even above it. This swelling is due to the effused blood, encysted by lymph, omentum and adherent coils of intestine. Except for its subtympantic resonance and the fact that it is often somewhat asymmetrical, it closely resembles a distended bladder. It pushes the uterus forward and may seriously interfere with micturition.

CHAPTER XIII

HÆMORRHAGE IN EARLY PREGNANCY (*continued*)

Disturbed Tubal Gestation

THE vaginal bleeding in this case is usually slight but protracted and is dark coloured like prune juice. Sometimes it is so slight as only to be evident on vaginal examination with the finger or through a speculum and in a small percentage of cases (18 in Dougals series of 100 cases) it is absent altogether. It is due to separation of decidua formed in the uterus. Fortunately most tubal pregnancies end not in rupture but in tubal abortion the ovum being expelled into the abdominal cavity through the fimbriated end of the tube and intra peritoneal hæmorrhage of the severe diffuse variety is therefore comparatively rare. Leith Murray in a series of 146 disturbed tubal pregnancies met with only four desperate emergencies.

When vaginal bleeding is due to disturbance of a tubal gestation there is usually a more or less definite history of early pregnancy such as a short period of amenorrhœa (one or two missed periods) and possibly morning sickness and very early breast signs. There may however be no history of amenorrhœa. This may be due to the fact that the patient mistook vaginal bleeding for menstruation or may mean that disturbance of the tubal pregnancy occurred before the first menstrual period after fertilization of the ovum was due. In Dougals series above referred to there was amenorrhœa in only 72 per cent.

Usually however after one or two missed periods there is a sharp attack of pain in one iliac fossa always that on the side of the diseased tube. The pain is rarely absent (present in 97 per cent of Dougals cases) is sharp sudden and cramp like and is often accompanied by a feeling of sickness and faintness. This again is typically followed by vaginal bleeding of the kind described above. The classical signs therefore of disturbed tubal gestation are amenorrhœa pain and bleeding and in that order. Vaginal bleeding may however precede the pain or their onset may be simultaneous.

As the most common ending of a tubal pregnancy is tubal abortion or the formation of a tubal mole intra peritoneal bleeding is usually comparatively slight and takes place slowly from

fully scrutinised. Neither is there need for the practitioner to be absolutely sure of the diagnosis, it is sufficient for him that there is *suspicion* of ectopic gestation and it is then his duty to have the patient removed at once to an institution where a thorough investigation can be carried out.

Usually there is a fairly typical history of early pregnancy of at least one missed period, of breast signs (p. 20), and possibly of morning sickness. It will often be found however on careful enquiry that the pregnancy was not quite normal and that there was occasional rather indefinite cramp like pain and discomfort in one or other side. This is probably due to the abnormal tubal distension and vascularity. It is liable to occur a considerable time before the tubal pregnancy is in any way disturbed, and may even, in fortunate cases, lead to a diagnosis at that early period. A careful and gentle bimanual examination will reveal slight softening of the cervix, some enlargement and softening of the uterus, and at the side of the uterus a *tense, tender and pulsatile swelling*. The importance of tenderness has been referred to above. The enlargement of the tube may, however, be so slight that even expert palpation may fail to discover it because *disturbance of the gestation may occur at an extremely early stage*, before the tube is palpably enlarged. Nixon draws special attention to pulsation in the fornix of the affected side. The tip of the index finger should rest gently in the region of the attachment of the vagina to the cervix. It is there that pulsation is best felt. Only light pressure should be applied for if it is too firm the pulsation will be obliterated. R. L. Dodds stresses the diagnostic importance of pain on moving the cervix.

If a pelvic hæmatocele has formed there may be a visible abdominal swelling, but much more often such a swelling is absent. On vaginal examination the hæmatocele has an indefinite outline, is immobile, is tender, and there may be the crepitant sensation previously (p. 182) referred to. Much help may be obtained from careful investigation of shreds of any material discharged from the uterus, all of which should be preserved for examination. In ectopic pregnancy a decidua is formed in the uterus and this is expelled either in shreds or as a complete cast. There are, of course, no chorionic villi, and their absence will be easily revealed by the microscope. If chorionic villi are present there is an intra-uterine pregnancy. In carrying out this examination there is no need to make paraffin sections. It is sufficient to tease a little of

Cullen's Sign In 1919 T. S. Cullen, of Baltimore, described a sign that is occasionally present "when the abdomen contains an abundant quantity of free blood arising from a slow persistent bleeding, rather than from a sharp and severe one" In such cases the "umbilicus may in some way imbibe the blood and appear bluish black so that in time one gets the same play of colours that one gets with a black eye—the greens and yellows" Apparently it is most likely to occur in the skin covering an umbilical hernia, or in the region of a rectal diastasis It is, however, so rarely present as to be of little value in diagnosis—it was present only once in 149 cases described by Bortini, in four of which there was umbilical hernia

Bimanual Findings in Pelvic Hæmatocele. The cervix is somewhat softened, and the uterus is usually enlarged to the size of a two months' pregnancy Hegar's sign is negative though the *entire uterus feels soft* Typically, at one or other side of the uterus a swelling is found which is about the size of a hen's egg, and is tense, tender and pulsatile The excessive tenderness of the swelling is an important diagnostic feature It is not, however, always present, and Scheffey, Morgan and Stimson only recognised it in 56 per cent of fifty five cases Johnstone emphasised the diagnostic value of tenderness in the posterior fornix Even though there is an effusion of blood in the pouch of Douglas it may not be palpable until clotting has occurred, which usually is not for some hours or even one or two days After it has clotted it is felt as a boggy mass with ill defined relations Occasionally, when the clot is undergoing organisation, a very characteristic crepitant sensation is detected by the examining finger, somewhat like that felt when squeezing a lump of soft snow

In the diffuse and severe form of intra peritoneal bleeding very little can, as a rule, be made out on bimanual examination, though in favourable circumstances an effusion may be found in the pouch of Douglas, and the swelling at the side of the uterus

Diagnosis The classical signs of a disturbed ectopic pregnancy are amenorrhœa, pain in one or other iliac fossa, and vaginal bleeding, and occurring in that order As previously pointed out, none of these signs is constant, but pain is the most frequent of all and is rarely absent There may, too, be a history of recent fainting attacks Even when the history is not typical suspicion will usually be aroused if a complete history is obtained and care

fully scrutinised. Neither is there need for the practitioner to be absolutely sure of the diagnosis, it is sufficient for him that there is *suspicion* of ectopic gestation, and it is then his duty to have the patient removed at once to an institution where a thorough investigation can be carried out.

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the fresh material in saline and examine immediately with a low power objective without staining when the long slender thread like branching villi are easily seen. Much assistance will usually be given by the Zondek Aschheim or Friedman reactions which become positive in three to five days after the first missed period.

Exploratory puncture of the pouch of Douglas has in recent years been a good deal practised for diagnostic purposes. A large needle with syringe attached is pushed through the posterior fornix into the swelling in the pouch of Douglas. If blood or a bloody fluid is withdrawn it is regarded as confirmation of the presence of a pelvic hæmatocele. Such a procedure is not however free from danger as it may introduce infection or a large vein may be punctured. Even though blood or a bloody fluid is obtained it may be misleading. A case has been observed in which the blood came from a sactosalpinx that had become twisted with resulting hæmorrhage into it and another in which the needle apparently entered a hæmorrhagic Graafian follicle the enlarged cystic ovary containing it lying low in the pouch of Douglas. Puncture while occasionally a useful procedure should only be carried out in the surroundings of a hospital or clinic with all aseptic precautions and with preparations completed for immediate laparotomy.

Differential Diagnosis *Uterine Abortion* The cramp-like pain in one or other iliac fossa is absent. The vaginal bleeding is apt to be more profuse and less protracted. Von Cress and Brown point out that while the blood in uterine abortion is red and remains so in ectopic pregnancy the discharge gradually assumes a dirty brown colour. The brown discharge is they consider almost pathognomonic. On vaginal examination Hegar's sign may be present but it will be recalled that this is only positive between the 6th and 10th weeks. There is no swelling at the side of the uterus and perhaps most important of all tenderness is absent in the vaginal vault and along the course of the tubes. Examination of decidual shreds for chorionic villi will furnish conclusive evidence. If present they are of course evidence of intra uterine pregnancy.

Metropathia Hæmorrhagica In this condition there may be a continuous bleeding preceded by a period of amenorrhœa. The fallopian unilateral cystic ovary may simulate an enlarged tube. There will however no history of pain (which is rarely absent in ectopic

pregnancy), and the swelling at the side of the uterus is not tender. Curettage of the uterus will reveal the characteristic Swiss cheese pattern of endometrium.

Retroverted Gravid Uterus This may lead to retention of urine and so may a pelvic hæmatocele. The fundus in the pouch of Douglas may be mistaken for a pelvic hæmatocele, but the latter has a less definite outline. The uterine fundus is not tender, while a pelvic hæmatocele may be, and rectal examination may reveal the relation of the utero sacral ligaments to the swelling. In retroverted gravid uterus the position and direction of the cervix are usually very characteristic (p. 293). In pelvic hæmatocele the cervix is pushed forwards against the pubes, but points downwards. The dull note given on percussion of a distended bladder is very different from the subtympantic resonance of the supra pubic swelling of pelvic hæmatocele. If there is any doubt the passage of a catheter will solve it.

Appendicitis Differential diagnosis is here of little importance as immediate operation is best in both. In appendicitis the absence of any history of early pregnancy, the higher situation of pain which begins at the umbilicus or in the epigastrium and only later settles down in the neighbourhood of McBurney's point, the absence of vaginal bleeding, the normal size of the uterus etc. all should help. It is well known that pulse and temperature may be normal throughout in appendicitis. If there is doubt a mid line incision should be made as it allows complete exploration of the pelvis.

Pyosalpinx, with or without Effusion in the Pouch of Douglas There is usually a history of infection. There may be vaginal bleeding in acute salpingitis, but there is usually no history of early pregnancy. The temperature is important. In pyosalpinx it tends to be high—over 100°—and is raised from the start of the illness. In uninfected ectopic pregnancy it may be normal or may be slightly raised after the third day. In inflammatory disease the uterus is more fixed, while leucocytosis is usually definite but is absent in ectopic, unless there is infection. Exploratory puncture of the swelling in the pouch of Douglas may be carried out and the Zondek Aschheim test may give important information.

In cases with severe diffuse internal hæmorrhage differential diagnosis is of little importance, and precious time should not be wasted on it, but exploratory laparotomy carried out as soon as preparations can be made. When a woman of child bearing age

is suddenly taken ill with all the classical signs of internal hemorrhage—abdominal pain, air hunger, fainting, rapid weak pulse, pallor, cold extremities, etc.—the medical attendant's first thought should always be 'ruptured ectopic'. True, the condition may be due to some other rarer cause of intra-peritoneal hemorrhage, such as rupture of the spleen, of a distended vein on the surface of a large fibro-myoma, of a varicose vein in the pampiniform plexus, or of a very vascular Graafian follicle, or to bleeding into an ovarian cyst with twisted pedicle, while similar symptoms may be caused by perforating peritonitis from a ruptured gastric or duodenal ulcer or appendix, or even on occasion from the twisting of the pedicle of an ovarian cyst. All are urgent, all require immediate laparotomy, and the patient should be put without loss of time, or useless and often fruitless attempts at differential diagnosis, into surroundings where this can be carried out.

While awaiting operation the patient must be kept absolutely at rest with an ice bag on the abdomen, and if much collapsed the foot of the bed may be raised. If restless morphine $\frac{1}{4}$ may be given hypodermically, but no stimulants, no transfusion, and no enema should be given, as any of these may start fresh bleeding.

In all urgent cases laparotomy should be performed as soon as possible through a mid-line incision. Intravenous saline or a blood transfusion should be given by an assistant as soon as the bleeding points have been secured, or auto-transfusion, first advocated by Thies in 1914, may be employed. The blood, or as much as possible of it, is collected with the help of an aspirator or otherwise, citrated (50 c.c. of a 2½ per cent solution of sodium citrate are enough for one pint of blood), filtered through gauze, and then returned to the patient through an arm vein. Of course, if the blood is infected or contaminated it cannot be used, and the more recently it has been extravasated the better. That even the worst cases are never quite hopeless is well illustrated by a case recorded by Kaiser. The woman was admitted pulseless. He drew on sterile gloves and opened the abdomen at once, an assistant at the same time giving intravenous saline. Meantime the patient's breathing and heart beats ceased, and in spite of artificial respiration she seemed clinically dead. An intra-cardiac injection of adrenalin was given and complete recovery took place.

If the hemorrhage is slight and not progressing, operation is less urgent, but is nearly always eventually advisable. It guards

against the possibility of recurrence of hæmorrhage, and of occurrence of infection of a pelvic hæmatocele, while the patient is usually ensured a more rapid convalescence. There is no doubt, however, that good results can be obtained by expectant treatment in selected cases. The expectant method can be adopted with more equanimity if the Zondek Aschheim reaction is negative, as this shows a dead ovum. If the test is positive and continues so, operation should be undertaken without delay.

REFERENCES

- BORTINI *Med Review* (Abst.) 1929 32 280
 CULLEN T S *Contrib to Medical and Biological Research* (Osler I volume)
 New York 1919, I, 420
 DODDS, R. L. *Proc Roy Soc, Lond*, London, 1939-40 33, 783.
 DOUGAI D *Brit Med Jour* 1927 ii 1074
 JOHNSTONE, R J *Brit Med Jour*, 1927, ii 1077
 KAISER KURT *Medizin Klinik* 1932 28 ii 1038
 MURRAY, LEITH H *Proc Roy Soc Med London* 1932 25, 1375
 NIXON, W. C. W. *Brit Med Jour*, 1937 ii 579
 SCHIFFF, L. C. MORGAN I R and STIMSON C M *Am Jour Obst and Gyn*, 1932 24, 103
 THIES, L. *Zent f Gynäk* 1914 38, 1191
 VON GRAFF, E. and BROWN P T *Jour Am Med Assoc* 1937, 103 371

CHAPTER XIV

HÆMORRHAGE IN EARLY PREGNANCY (*continued*)

Hydatidiform Mole

THE bleeding in this case usually occurs about the end of the third month. It may however never be a prominent feature and may even be altogether absent.

Vaginal bleeding is usually the first sign that the pregnancy is abnormal. It sets in early and may be at first nothing more than a bloodstained watery discharge. The watery part of the discharge is derived from rupture of some of the distended thin-walled vesicles—each one really a dropsical chorionic villus—and the blood from separation of the vesicles from the wall of the uterus. Not infrequently the bleeding may be very severe when it may escape externally rendering the patient exsanguine in a few minutes or it may be entirely concealed causing great and sudden enlargement of the uterus which then becomes hard and tender. These excessive hæmorrhages are due to penetration of the maternal sinuses in the wall of the uterus by the chorionic epithelium which is present in great excess and very active and seems to have preserved that power of invading the wall of the uterus and especially the maternal vessels which is one of its outstanding characteristics in the early phases of the development of the placenta (the implantation syncytium).

Sometimes bleeding is entirely absent and excessive vomiting (hyperemesis) is the symptom that brings the patient for advice. This vomiting may be extremely severe and uncontrollable.

Pre-eclamptic toxæmia is more frequent than in normal pregnancy and albuminuria may be as much as 10 parts per 1000 but there may on the other hand be no evidence of toxæmia throughout the whole course of the disease. If albuminuria is present there is often œdema of the lower extremities and elsewhere and the blood pressure is raised. Even eclampsia may supervene and according to Essen Möller eighteen cases of it have been reported. Hitschmann observed one at the 5th month.

On examination the uterus may be larger than it should be for the period of pregnancy so that at the end of the third month it may reach to the umbilicus or even occasionally to the costal

margin. Sometimes however, the uterus is smaller than the duration of pregnancy would indicate. Of thirty seven cases in the London Hospital in which the duration of pregnancy and the size of the uterus were recorded, Brews found that the uterus was unduly enlarged in twenty four smaller than normal in eight, and the correct size in five. Not infrequently a very rapid or even sudden enlargement takes place from concealed hæmorrhage, and this is then associated with pain and tenderness. Because there is no liquor amni and the mole fills the uterus, the uterus has a characteristic doughy consistence, and unless there is a fœtus present as well as the mole as may happen in a twin pregnancy when one ovum is normal no fœtal parts can be felt nor ballottement elicited, and fœtal heart sounds are absent, but there may be a uterine souffle. A brown discharge similar to that found in a missed abortion, is sometimes found. It is due to the passage of old blood clot, and it may be the only discharge present.

On vaginal examination the absence of fœtal parts and of ballottement is confirmed and a unilateral or bilateral cystic tumour may be felt behind the uterus in the pouch of Douglas. These are the bilateral lutein cysts of the ovary which are so often associated with hydatidiform mole and chorion epithelioma. They are probably always present but may not be large enough to be felt *per vaginam*. Each ovary may contain as many as forty or more cysts, the cysts being thin walled, lined by a few luteal cells, and containing straw coloured fluid. They are probably due to stimulation of the Graafian follicles by the anterior pituitary like substance which is present in great excess in the urine, so that they undergo partial development and luteinisation. Each ovary may be as large as a cricket ball, but unless chorion epithelioma develops they always undergo involution rapidly after the mole is expelled.

Diagnosis. The condition should be suspected if the uterus is much larger than it should be about the end of the third or beginning of the fourth month. It should not be forgotten that signs of toxæmia and even vaginal discharge of any kind may be entirely absent. On the other hand the occurrence of pre-eclamptic toxæmia at such an early period of pregnancy should arouse suspicion. A careful investigation of the menstrual history should be made to ensure that the patient has not mistaken the duration of pregnancy. The occasional occurrence

of hyperemesis is to be kept in mind. The doughy consistence of the uterus, the absence of foetal parts, possibly the presence of a tumour in the pouch of Douglas, usually leave little doubt about the diagnosis. If there is a bloodstained watery discharge it should all be kept and carefully inspected for vesicles which make the diagnosis certain but are seldom found. An X-ray examination fails to show a foetus unless, of course, there is a normal twin.

Although the diagnosis of hydatidiform mole cannot be made on the biological assay of gonadotropic hormone in the urine, this assay can be a useful aid to diagnosis. The maximum excretion of gonadotropic hormone in normal pregnancy occurs at about the 10th week, and the excretion is considerably higher than normal in patients with hyperemesis gravidarum. Although it is probable that in some cases of hydatidiform mole a higher excretion of gonadotropic hormone occurs than in any other condition except chorion epithelioma, there is a wide range of excretion values in which no distinction is possible.

Wide divergences of laboratory technique make a comparison of actual values obtained by different workers impossible. If the immature rabbit technique (p. 25) is used, the peak period of normal pregnancy gives positive results with as little as 0.02 c.c. urine injected. In hyperemesis this amount falls to 0.04–0.02 c.c., and cases of hydatidiform mole give positive reactions with 0.03 c.c.–0.006 c.c. If the immature mouse is used as test animal, six doses of 0.05 c.c. of a $\frac{1}{100}$ dilution of urine should give a positive result for the presence of hydatidiform mole to be suspected. Zondek (1937) considers that a positive test must also be obtained from the cerebro-spinal fluid.

Differential Diagnosis. Besides carneous mole there are two conditions that may be mistaken for hydatidiform mole, namely, hydramnios in uniovular twins, and retroverted gravid uterus with a distended bladder. Either of these may cause undue enlargement of the abdomen in early pregnancy, but a careful consideration of the clinical features and use of the various diagnostic means at our disposal should rule them out.

Prognosis. The mortality is stated by Hitschmann to be about 10 per cent. The chief dangers are hæmorrhage, sepsis, and later, chorion epithelioma. Because of the tendency of the vesicular mole to eat deeply into the uterine wall and invade the maternal blood sinuses, there is always a risk of serious bleeding, either

spontaneous or during artificial evacuation of the mole. Occasionally, while still *in situ* the mole may develop malignant changes perforate the uterus and thus lead to fatal intra peritoneal hæmorrhage or even metastasis chiefly to the lungs. The remote risk is chorion epithelioma which may develop while the mole is still *in situ* soon after evacuation or even after some years. In Findley's series of 290 cases 124 developed chorion epithelioma. Probably however the real risk is much less than this as the benign cases are not often reported. Brews reports that of 72 cases of hydatidiform mole occurring in the London Hospital since 1912 six developed chorion epithelioma (8.3 per cent). Essen Møller reports that in his series of 50 cases eight (16 per cent) became malignant and that in the women over forty five the risk of chorion epithelioma was more than double that in younger women. He therefore advises that hydatidiform mole in women over forty five should be treated by hysterectomy. Hitschmann states that out of 440 cases of mole chorion epithelioma developed in twenty one (5 per cent). The same author states that of 100 chorion epitheliomas the antecedent condition was hydatidiform mole in forty eight an abortion in twenty six a full time pregnancy in twenty five and a tubal pregnancy in two. In a few reported cases there have been repeated molar pregnancies but it is usual for the succeeding pregnancies to be normal. Mack and Catherwood report the case of a woman who had ten in succession the tenth ending in chorion epithelioma. Though the woman was married twice, she never had a normal pregnancy, eight moles occurring in her first and two in her second marriage which supports the view usually held that the cause lies in the unfertilized ovum.

Treatment Many moles (according to Essen Møller about 50 per cent) end in spontaneous evacuation but if this does not take place the pregnancy should be terminated as soon as the condition is diagnosed. There are various methods of doing this.

Manual Evacuation of the Uterus from below Unless in exceptional cases and for special reasons, this is the method of choice.

Special Preparations necessary Hypodermic injections of pituitary extract and ergot.

Douche apparatus with double channel intra uterine nozzle.

A large supply of boiling water for preparation of intra uterine douches.

About 18 yards of sterile gauze for packing the uterus, if necessary

Besides the usual instruments for vaginal operation, such as a weighted speculum, volsella, ring forceps, etc., an ovum forceps should be available

Preparations for saline infusion If there is time, a blood donor should be provided and the patient typed before the operation is begun. All other preparations should be made for blood transfusion, especially if much blood has been lost before the start of the operation

The Operation If the cervix and internal os are closed one or more laminaria tents should be inserted in the cervix for about twelve hours. This should be done with full antiseptic precautions and without using an anæsthetic. Not only does the tent dilate the cervix but it helps to induce uterine contractions. After twelve hours or so a general anæsthetic is given, and the patient put in the lithotomy position. The vulva is shaved, if this has not been previously done, washed with soap and water, and then with 1 in 1,000 perchloride of mercury, a catheter passed, the tents removed and a vaginal douche given of 1 in 1,000 perchloride of mercury. The cervix will now usually be found to admit two fingers which is all that is necessary to allow the mole to be removed. If it is not sufficiently dilated, this may be done by graduated metal dilators, and is usually an easy matter, as the cervix has been rendered soft and dilatable by the tent. It is necessary to get the half hand into the vagina, and this should therefore be ironed out as previously described (p 177). The half hand, well lubricated, is introduced into the vagina and one or two fingers into the cavity of the uterus. The mole is then gradually separated starting below in the region of the internal os and at the same time the fundus is pushed down and squeezed by a hand externally, usually that of the operator, a sterile towel being placed over the fundus. After some portion has been separated it should be withdrawn by the ovum forceps and the process repeated. Attempts should be made to squeeze out as much as possible by pressure from above. Retraction and contraction can also be aided by frequent hot intra uterine douches at 118° F. Ergot preferably in the form of ergometrine, and pituitary extract should be injected at an early stage of the operation. It is remarkable how with this method the uterus lessens in size so that every part of its inner wall, including the fundus, comes

within reach of the finger. When the uterus is almost empty the finger should seek round its entire wall, separating any remaining pieces of mole, blood clot, etc. When every piece has been removed a final hot douche should be given and the vagina firmly packed with gauze which should be left in for about twelve hours (overnight). It is then removed and a hot vaginal douche given. It is important to remove every particle of mole, for if any be left behind adherent to the wall of the uterus, it probably increases the risk of chorion epithelioma.

No curette should be used. It is unnecessary and dangerous, for the wall of the uterus is extremely thin and easily perforated.

Risks of the Operation (1) *Hæmorrhage*. This is the chief immediate risk, and the hæmorrhage may be very severe and alarming. Much blood has often been lost before the start of the operation, and this increases the danger. It is a good rule to evacuate the mole as far as possible by squeezing above, rather than by gouging it out from below. Often however it will be found impossible to expel much by squeezing until the lower pole of the ovum has been broken up by the finger below. The uterus should be induced to contract by the use of pituitary extract, ergot, and copious hot douches. If bleeding still continues after the mole is evacuated, the uterus and vagina should be firmly packed with sterile gauze and a tight binder and T bandage applied. The value of blood transfusion has been already referred to, and it should always be carried out if there has been much blood loss.

(2) If a curette is used there is great danger of *perforating the uterus*. There is, however, no need to use the curette, even at the end of the operation, to ensure that the mole is all removed, as this is much better done by the finger alone. At this stage, however, the use of the curette is safer, as the uterus has retracted, and its wall has therefore become again comparatively thick. Should perforation occur, the best treatment is usually laparotomy followed by removal of the uterus. Circumstances, however, might exist in which such drastic treatment would be inadvisable. For example, the patient might be too much collapsed to stand it, or she may be a young woman with no living child, in which case it may be important to save the uterus. In such a case it may be best to pack the uterus with sterile gauze, which is removed at the end of twenty-four hours.

(3) *Sepsis* This is favoured by the loss of blood. The risk is reduced to a minimum by the exercise of strict surgical cleanliness at every stage of the operation and by blood transfusion.

Other Methods of Treatment While evacuation from below is to be advised as a routine in exceptional cases other methods may be preferred. These are abdominal hysterotomy and hysterectomy.

Abdominal Hysterotomy The uterus is opened as in Cæsarean section and the mole evacuated. The greatest care must be taken to protect the abdominal wound and contents from contact with the vesicles. The former should therefore be covered with rubber sheeting and the latter by careful gauze packing. Needless to say the large cystic ovaries should not be removed. Provided the contents of the uterus are not infected this method has much to recommend it. Hæmorrhage is reduced to a minimum especially if pituitary extract is injected into the muscle of the uterus before opening it and the mole can be removed most cleanly from the wall of the uterus, thereby diminishing the risk of chorion epithelioma.

Abdominal Hysterectomy This is good treatment if the patient is approaching the menopause and has already the desired number of children. Risk of chorion epithelioma is thereby almost entirely eliminated. Essen Møller advises that hysterectomy should always be performed after the age of forty-five as the risk of chorion epithelioma is then more than twice that in younger patients. Total hysterectomy is preferable to subtotal as it avoids all danger of soiling the peritoneum with vesicles and it is advisable for the same reason to close the external os by sutures beforehand.

Disadvantages of the Abdominal Methods Apart from the fact that these are operations that call for special experience of abdominal surgery there is probably a greater risk of septic peritonitis following them than there is in most other operations on the uterus. The risk is greater if the patient has been bleeding for some time as the clot collecting in the lower part of the uterus and cervical canal forms a favourable culture medium. Neither is the uterus protected from infection by an amnion and normal chorionic membrane as it is in an ordinary pregnancy. The risk in abdominal hysterotomy is therefore comparable to that in Cæsarean section when the membranes have been ruptured for a considerable time.

After Care It is of the greatest importance to look out for the earliest evidence of the development of chorion epithelioma, especially in the months following evacuation of the mole. In this connection the Zondek Aschheim reaction is most valuable, and should be used as a routine. It always becomes negative in normal pregnancy within 36 hours after delivery (Crew) but in hydatidiform mole it may remain positive for two or three weeks or even occasionally for three to six months. Zondek is of opinion that a positive test six weeks after expulsion of a mole is in favour of chorion epithelioma and the probability is much greater if the concentration of hormone is increasing. The test usually however becomes negative in a fortnight and *should then remain negative*. If it again becomes positive we should suspect either another pregnancy or a chorion epithelioma. In the latter case there is usually vaginal bleeding but not necessarily so at least in the early stages. If reactions II and III (p. 25) are positive with 01 c.c. of early morning urine chorion epithelioma should be suspected and the greater the dilution with which reactions II and III can be obtained the greater is the probability that this suspicion is correct. It is advisable to carry out the test at intervals which with the lapse of time may gradually increase for at least two years. The patient should of course be told to report at once if there is any intermenstrual bleeding. Diagnostic curettage should then be carried out together with dilution tests of the urine. Even should microscopic examination of the curettings show no evidence of chorion epithelioma definitely positive dilution tests of the urine which should be twice repeated are in themselves sufficient to justify panhysterectomy for the chorion epithelioma may be deeply seated in the muscular wall of the uterus without encroaching on the mucous membrane an occurrence that is explained by the tendency of the chorionic epithelium of a hydatidiform mole or chorion epithelioma to invade capillaries and veins and not always to spread by direct continuity.

Mucous and Fibroid Polypi

A *mucous polypus* of the cervix causes only slight more or less continuous bleeding—more a blood stained discharge than actual hæmorrhage. As catarrh (erosion) of the cervix is always present at the same time there is also a mucopurulent vaginal discharge. Diagnosis is easily made by feeling the polypus with the finger or viewing it through a speculum. It may be seen as a

small pink rounded or flattened body usually stalked and not larger than a cherry protruding from the external os. It should be snipped off with scissors.

A *fibroid polypus* is rare in pregnancy as fibroid tumours are usually associated with sterility. It may grow from the lower part of the wall of the uterus or from the inner wall of the cervix. It is usually pedunculated, is larger and firmer than the mucous polypus and may be the source of very severe bleeding. This takes place from the wall of the polypus itself which is liable to become ulcerated by friction, a large vessel sometimes being thus

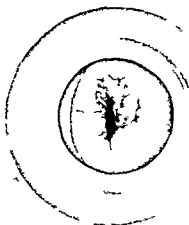


FIG. 28. Varicose veins of the cervix in pregnancy. Moderately severe ante partum hæmorrhage occurred in this case.

laid open. It should be removed immediately. All that is usually necessary is to snip through the pedicle with scissors or to seize the polypus with a volsella and twist it off.

Cervicitis with Cervical Erosion

The bleeding is in this case slight—no more than a red staining of the yellowish mucopurulent discharge that always occurs in cervicitis. On exposing the cervix with a speculum the characteristic bright red appearance of an erosion is seen around the external os. On rubbing the part with a cotton wool swab it bleeds slightly and on testing it with a probe or sound it is in the cervical canal and tough and not friable. This absence of any considerable tenderness on rubbing firmly and of friability is usually

enough to distinguish cervicitis from cancer of the cervix. No treatment is necessary for the hæmorrhage, but only for the cervicitis (p. 567).

Varicose Veins of the Cervix

Bleeding from this cause in pregnancy is very rare. We have seen one case in which the bleeding was fairly severe so that placenta prævia was suspected. On routine examination by the speculum a diagnosis was easily made (Fig. 28).

Cancer of the Cervix

This is a rare cause of hæmorrhage in early pregnancy. It is fully dealt with elsewhere (p. 516).

REFERENCES

- BRFWR, ALAN. *Proc Roy Soc Med London* 1935 28 1213
 CREW, F. A. E. *Brit Med Jour* 1936 1 363
 ESSEN MÖLLER, I. *Monatsch f Geb u Gynäk* 1925 69 361
 ESSEN MÖLLER, E. *Studien über die Blasenmole*. Wiesbaden 1912. (An interesting statistical study of hydatidiform mole.)
 FINDLEY, P. *Am Jour Obst* 1917 75 968
 HIRSCHMANN, F. *Biologie u Path des Weibes* (Hallan und Seitz) 1926 VII Teil 2, 459
 MACK, H. C. and CATHERWOOD, A. E. *Am Jour Obst and Gyn* 1930 20 670
 ZONDER, B. *J A M A* 1937 108 607

CHAPTER XX

UNSUCCESSFUL PREGNANCY

IN this chapter we shall discuss those cases in which women, in spite of the fact that they become pregnant repeatedly, never succeed in bearing a living and viable child. The discussion will include cases of habitual abortion, miscarriage, and spontaneous interruption of pregnancy before the period of viability, i.e., the end of the 35th or 36th week of pregnancy, and all cases of intrauterine death of the fœtus before the onset of labour. A simple and satisfactory classification of the causes is not possible in the present state of our knowledge, and the following is merely adopted for want of a better.

(1) Abnormalities in the Genital Organs of the Mother

Uterine Fibromyomata The liability to abortion varies with the position of the fibroid. If it is submucous the tendency to abortion is very great, less but still considerable if it is interstitial or intramural while if it is subperitoneal the course of pregnancy may be but little interfered with, apart from such accidents as red degeneration. It should be remembered that even very small interstitial fibroids may cause repeated abortion. During pregnancy they enlarge rapidly, but they involute just as rapidly in the puerperium, and so may be exceedingly difficult to feel on bimanual examination and may be missed altogether unless the greatest care is exercised and possibly examination under anaesthesia carried out. If they are found myomectomy should be carried out and pregnancy avoided for a year afterwards.

Backward Displacement of the Uterus This may be a cause of repeated abortion though we know that in many cases in which pregnancy occurs in a patient with retroversion the uterus rises up into its normal anteverted position as pregnancy proceeds. If, however, no other cause for repeated abortion can be discovered except a retroverted uterus this should be cured by one of the ventrisuspension operations in which the round ligaments are shortened.

Infantile Uterus (Uterus fetalis) The patient with an infantile uterus is usually sterile, and if pregnancy occurs, abortion is very apt to take place. The history is said to be rather typical

In the first pregnancy abortion occurs about the 6th week, in the second somewhat later, and so on until finally a living child may be born at term. Diagnosis usually rests largely on supposition and is arrived at only after exclusion of other known causes of abortion. The administration of large doses of oestrogenic hormone during the intervals between pregnancies may cause the necessary degree of uterine hyperplasia and enable a pregnancy to continue till term.

Double Uterus This is a rare cause of repeated abortion. A. F. Miller in a series of 67 cases including one of his own and 66 collected from the literature, found that 19 or 28.3 per cent, terminated spontaneously before the period of viability. Diagnosis in these cases may be easy or difficult. There is often a double vagina which itself draws attention to the condition. If the vagina is single, bimanual examination may reveal the sulcus between the two horns of the uterus. If the sulcus is shallow and especially if there is only one cervix, diagnosis by this method may be difficult and then the injection of 10 c.c. of lipiodol followed by X-ray examination may be of great assistance. Treatment depends on the extent of the deformity, of which there may be many degrees varying from the cases in which there is a double vagina with two uterine horns divided above the level of the internal os, to the septate uterus which is normal externally with the exception of a dimple at the fundus. In the latter the uterus may be opened and the septum removed. In the more severe degrees (uterus bicornis) the repeated abortions are probably due to the horns being underdeveloped and it is therefore doubtful whether removal of one horn is of much use. Large doses of oestrin between pregnancies may be useful in bringing about fuller development.

Prolapse of the Uterus This rarely gives rise to abortion unless it is of extreme degree (procidentia). Repair of the pelvic floor should be carried out by an operation of the Fothergill type, but if possible, amputation of the cervix especially high amputation, should be avoided.

Lacerated Cervix A deeply split cervix, especially if the tear is bilateral is said to be a cause of repeated abortion. It should be repaired by an operation of the Emmett type, which results in the everted lips being brought neatly together without any loss of substance.

High Amputation of the Cervix Bryan Williams, enquiring

into the after histories of patients who had been operated on for genital prolapse found that of 49 pregnancies occurring in 37 patients in whom the cervix had been amputated as part of the operation 28 (69 per cent) ended in abortion. The risk of abortion depends on the level at which the cervix is amputated and it is probable that amputation at a low level is accompanied by little risk. Rest in bed throughout pregnancy may make abortion less liable to occur but beyond that nothing can be done.

Chronic Endometritis This condition used to bulk very largely in the etiology of habitual abortion and it was customary to curette the uterus when its existence was suspected. Histological proof of its presence was rarely, if ever forthcoming and the diagnosis like that of the infantile uterus was mostly reached only by excluding other recognised causes of abortion. Not infrequently the curettage was followed by a full term pregnancy and therefore seemed to be justified. Without admitting the existence of chronic endometritis as a pathological entity it may be said that provided other means of treatment fail there can be no harm in submitting the uterus to a thorough curettage.

Chronic Pelvic Peritonitis Patients who suffer from this disease are usually sterile on account of the closure of both Fallopian tubes by chronic salpingitis. Occasionally however at least one tube is patent and through this an intrauterine pregnancy may occur. Early abortion is then liable to follow especially if the uterus is retroverted and fixed by adhesions. We have recently seen such a case in which it seems reasonable to assume that the abortion was due to the pelvic peritonitis. The patient had mitral stenosis and aborted about the end of the third month. Sterilization was considered advisable and at laparotomy for this purpose old standing pelvic peritonitis was found the uterus being retroverted and adherent. The right tube was patent and through this conception had apparently occurred.

known that about 33 per cent of all macerated foetuses are syphilitic. The diagnosis sometimes presents great difficulty and is fully discussed in Chapter XXXIV, p 521. We would here emphasize particularly the value of the information to be gained from examination of the products of conception—foetus, placenta, and umbilical cord and in the case of neonatal death, by microscopic examination of the organs of the child, and this examination should in a difficult case, never be neglected. The possibility of congenital syphilis in one or other parent should not be overlooked. In such the Wassermann reaction is often, indeed usually, negative. In addition to examination of the parent for signs of congenital syphilis a careful investigation of the family history, including especially the reproductive history of any brothers or sisters may throw a flood of light on the true nature of the case. Where there is still doubt there can be no harm in carrying out the “therapeutic test,” i.e., submitting both parents to a course of arsenical therapy and continuing this in the mother during any succeeding pregnancy. Malpas has reported success in 20 out of 33 patients treated in this way.

Chronic Nephritis A full discussion will be found on p 357 *et seq*. Abortion usually preceded by intrauterine death of the foetus is a common occurrence though in the milder cases pregnancy often goes to term.

Essential Hypertension Unlike chronic glomerular nephritis chronic hypertension is common in pregnancy and is a frequent cause of abortion or miscarriage. The hypertension may be familial, or may be a legacy of a previous eclampsia or pre-eclamptic toxæmia. The diagnosis, clinical course and treatment are discussed in Chapter XXI, p 362. It may here be emphasized that the disease is often overlooked through neglect to estimate blood pressure and because it is not sufficiently realised that slight rises of blood pressure—over 130/70 in pregnancy are abnormal.

Diabetes Mellitus This may be a cause of repeated abortion preceded by death of the foetus though it is more usual for the foetus to die in the later months. Herrick and Tillman (1938) report four spontaneous abortions in a series of sixty-eight pregnancies and in one of our cases there were four consecutive abortions—at six, three and four months. To prevent it, close supervision is required from the start of pregnancy (p 419).

The intra uterine death may be due to ketosis in badly controlled

patients but it may also occur in patients in whom there is no ketosis as shown by the absence of ketone bodies from the urine. There is much reason to believe that the cause is then hypertensive toxæmia to which diabetic patients seem to be particularly liable. Generally speaking the risk of foetal death increases as pregnancy advances and it is very great after the 36th week. For this reason we now in common with most obstetricians advise Cæsarean section at the end of the 36th week. The child at this time may be as large as one at full time but it is said that they behave like premature babies and need much care. Our experience of them however has so far been favourable. Their liability to hypoglycæmia should be remembered (p. 448).

Abnormal Carbohydrate Metabolism Pillman Williams states that patients who have repeated unexplained abortions or miscarriages often have reduced carbohydrate tolerance as shown by a raised blood sugar tolerance curve and exaggeration of the delayed fall characteristic of pregnancy, but without any sugar in the urine while on a normal diet. In a group of normal pregnant women the highest average blood sugar during the test was 160 mg per cent and it had fallen to 100 mg at the end of two and a half hours. In the abortion group the corresponding figures were 210 and 150. Treatment by diet is advised. Instead of the customary three large meals a day six small ones are taken. The total carbohydrate intake need not be unduly reduced the amount given being 150-200 g a day, taken in rations of 30 g at approximately three hourly intervals. The series consisted of nineteen pregnant women all of whom had had more than two miscarriages or premature still births and no live infants the average being 3.2 miscarriages each. After the above treatment eleven had living full term infants one had a premature infant, two aborted three had miscarriages and in two others the result was unknown at the time of writing one of these being still undelivered. The percentage of successes was therefore 63.

Defects in the Germ Plasm It is well known to embryologists that in mammals with large litters a very large percentage (from 20 to 40 per cent) of the fertilized ova never reach maturity but die and are absorbed. This mortality is believed to be due to defective germ plasm rendering the vitality of the ovum so low that it is incapable of developing beyond a certain stage or leading to the formation of pathological ova. According to Keibel and Mall 80 out of every 100 human pregnancies end in the birth of

normal individuals 7 are aborted as definitely and obviously pathological ova and about 1 produces a monster. The remaining 12 "normal" fetuses and embryos are by no means all normal, for close examination often reveals in them especially in the younger ones minor abnormalities which must be viewed as forerunners of real monsters. Of ova aborted in the first month Mall found only one fifth normal. From the second month only half were normal. Very few abnormal ova are found in abortions after the second month and those that survive this period will probably go to term and produce monsters. Of 104 abortion ova studied by Huntington 82 were found to be pathological. The abnormality may be in the embryo itself or in its membranes or in both. In the membranes it often takes the form of hydatidiform degeneration of the chorion. Keller and Adrian in 305 abortions studied found this present in 68 per cent. It usually only affected some of the villi and though it might be visible to the naked eye it generally required careful microscopic examination for its detection.

Regarding the causes of these defects in the germ plasma that lead to early abortion or to developmental abnormalities little is known, and less that is of value in therapeutics. It is believed that in certain families ova of low vitality are habitually produced that are incapable of development to term or even beyond the first weeks after fertilization except in the most favourable circumstances, and the same may be true of the production of pathological embryos though these are not usually repeated. A careful review should be made of the patient's health, septic foci should be eradicated and any injurious habits corrected. There is some reason to believe that incompatibility between the male and female partner may lead to repeated unsuccessful pregnancy even though both ovum and sperm are normal.

Hormonal Deficiencies Before considering these let us traverse the facts so far as they are known concerning the action and interaction of the hormones believed to be concerned in the maintenance of normal pregnancy.

Gonadotropic Hormone This appears in the urine almost immediately after implantation of the ovum, its presence forming the basis of the Zondek Aschheim and Friedman tests for pregnancy. Its amount rises rapidly to a peak which is reached about the sixtieth day after the first day of the last menstrual period, when a very large quantity is being excreted. The actual

amount varies considerably and it is not unusual to find quantities being excreted at this time such as were formerly thought to be characteristic of hydatidiform mole or chorion epithelioma. The excretion only remains at the peak for a few days and then rapidly falls to a low level which is reached about the 100th to the 120th day and which is maintained till term. After delivery it disappears altogether in four or five days. It is believed that the gonadotropic hormone is formed entirely by the placenta. It has been shown that injection of it prolongs the life of the corpus luteum, and that as the corpus luteum gets older, larger and larger quantities are necessary to maintain it in an active state. This may be the purpose of the rapid increase which occurs in the first three months—to maintain the corpus luteum until the placenta takes over the formation of progesterin.

Theoretically, therefore, deficiency of gonadotropic hormone in early pregnancy might be responsible for abortion through failure to maintain the corpus luteum. It may be surmised too that certain abnormalities of the chorion might be responsible for such deficiency but the nature of these has not been ascertained. The amounts of gonadotropic hormone excreted in normal pregnancy are shown in Table VI.

TABLE VI *Variations in Urinary Excretion of Gonadotropic Hormone and Pregnandiol in 8 Cases of Normal Pregnancy (Browne Henry and Venning) Days are counted from the first Day of the last Menstrual Period*

Days.	Gonadotropic hormone Rat units in 24 hours.	Pregnandiol. m.g. in 24 hours.
28- 56	700- 50 000	5- 11
56- 84	10 000-200 000	6- 20
84-112	3 000- 28 000	10- 28
112-140	2 000- 10 000	13- 35
140-168	1 000- 10 000	22- 52
168-196	1 000- 15 000	40- 72
196-224	3 000- 12 000	48- 85
224-252	1 000- 24 000	55- 95
252-280	2 000- 10 000	60-105

The methods of biological assay used in the quantitative determination of gonadotropic hormone involve great possibilities of

error. Hence, for any figure to be regarded as significantly abnormal it must be compared with values worked out for normal controls in the same laboratory, and must differ from them by a considerable margin (Taylor and Scadron). Furthermore, assays made on successive days on the same patient may vary considerably so that a single estimation is insufficient to determine the characteristic prolactin content of any particular patient.

Œstrin In the first seven days of the menstrual cycle this is absent from the urine. By the seventh day of the cycle it begins to appear, being secreted by the cells of the stratum granulosum of the developing follicle. The amount reaches a peak (about 600 I U) at the time of ovulation and then rapidly falls. It gradually rises again during the luteal phase and reaches a second peak of about the same height as at ovulation, a day or two before the onset of menstruation. During this second or luteal phase of the cycle the Œstrin is secreted by the corpus luteum. If pregnancy ensues its formation continues, first by the corpus luteum and placenta, and after the corpus luteum degenerates towards the end of the third month, by the placenta alone. Quantitative estimations of its excretion in the urine have been made by numerous workers, but it cannot be said that the results have been consistent. This is partly due to the fact that excretion even in the same patient, varies much from day to day, and partly to variations in technique that make comparison of results impossible. Generally speaking it may be said that there is a gradual increase during the first three months of pregnancy, after which increase takes place much more rapidly, reaching a peak a few days before parturition, when about 25 milligrammes of the crystalline hormones are being excreted daily ($1 \text{ mg} = 10,000 \text{ I U}$). After delivery the quantity falls rapidly to a very low level. It will be seen that the Œstrin curve in pregnancy is much the same as that of pregnandiol (*vide infra*).

According to Cohen, Marrian and Watson 99 per cent. of the Œstrin in pregnancy is in a combined and physiologically inert form till shortly before labour, when the amount of free and therefore active Œstrin increases considerably. This increase in free Œstrin may account for the onset of labour. One of the chief functions of Œstrin in pregnancy is to bring about the necessary growth of the uterus and other generative organs. It is conceivable therefore that a deficiency of Œstrin might lead to habitual abortion, or that excess of "free" Œstrin might so

sensitise the uterus as to make it throw off its contents. No work has however been done on these subjects.

Progesterin Fraenkel and Cohn (1901) demonstrated experimentally in rabbits the importance of the corpus luteum in the implantation of the ovum and the maintenance of pregnancy. In 1910 Boum and Ancel showed that the corpus luteum prepared the endometrium for embedding of the ovum and they thus provided a morphological explanation of Fraenkel's results. In 1929 Allen and Corner confirmed these results and showed that if both ovaries were removed fourteen to eighteen hours after mating the endometrium did not undergo proper preparatory proliferation and the ovum died in the blastocyst stage soon after entering the uterine cavity but that if corpus luteum extract were injected the pregnancy proceeded to term. There is also considerable though still rather inconclusive evidence that corpus luteum extract desensitizes the muscle of the uterus thus making it less liable to contract violently and expel its contents. Progesterin the hormone produced by the corpus luteum is estimated in terms of its excretion product in the urine the physiologically inert sodium pregnandiol glucuronidate. The amount of this in the urine is believed to correspond with the amount of progesterin in the blood and formed in the corpus luteum or placenta. Pregnandiol is absent during the follicular phase of the menstrual cycle but can be isolated from the urine twenty four to forty eight hours after ovulation and continues to be excreted during the remainder of the premenstrual phase till about one to three days before the start of menstruation. During this time its amount varies between from 1 to 6 mg in twenty four hours. If however pregnancy occurs pregnandiol does not disappear from the urine but continues at about the same level or a little higher i.e. from 4 to 10 mg in twenty four hours until about the seventieth day of pregnancy. From this level it then gradually rises reaching its highest about the ninth month at which time about 70 to 100 mg are being excreted daily. It disappears from the urine in from twenty four to seventy two hours after delivery (Browne Henry and Vennung). Up to the seventieth day or thereabouts the progesterin probably comes from the corpus luteum. After that time the placenta gradually takes over as the corpus luteum degenerates. It will be evident therefore that between the period when the corpus luteum gives up and the placenta takes over there may be a gap during which the supply of progesterin is

insufficient. This period is sometimes known as the critical phase as abortion is then more apt to occur—a view that corresponds well with clinical observations. In Table VI is given the amount of pregnandiol obtained from the urine in eight cases of normal pregnancy. The variations are very wide even in normal women in the same woman in different pregnancies and in the same woman from day to day. Great caution is therefore necessary in the interpretation of results of pregnandiol assays and one estimation alone is of little value. It is usually assumed too that the constant presence of progestin is necessary to the maintenance of pregnancy but that this is not so is shown by several cases now reported in which pregnandiol was absent from the urine for short periods and yet the pregnancy continued. Then there is the well known case of Jones and Weil in which the corpus luteum was removed at the fifty seventh day of pregnancy. Pregnanndiol was present in diminishing amounts for three days after operation and then was absent for eight days when it reappeared apparently on the placenta taking over its formation and gradually increased to the normal amount. There were never any signs of abortion and the pregnancy continued to term.

On these theoretical grounds the corpus luteum extract progestin and its synthetic equivalent progesterone have been extensively used in the treatment of habitual and threatened abortion. In the former condition 2 to 5 mg may be injected intramuscularly every other day till the end of the 16th week at which time the ovum is firmly implanted and the treatment may therefore be safely discontinued. However on account of its alleged action in desensitizing the uterus many clinicians advise the continuance of the injections weekly or twice weekly till the end of the 34th week. Kaufman advises the injection of 10 mg once weekly in habitual abortion and a double dose in the week during which a period would have occurred if the patient had not become pregnant. It is advisable meanwhile to keep the patient in bed and as free as possible from worry and excitement and marital relations should of course be avoided entirely.

Clearly injections are only necessary and will only be of value if the amount of progestin already available is below normal. It is therefore advisable that if at all possible estimations of pregnandiol should be carried out before treatment is begun otherwise a costly preparation may be wasted.

As for results Falls, Lackner and Krohn in 1936 reported the

treatment with progestin of 41 cases of threatened or habitual abortion with 34 successes. Kane in the same year reported 40 cases treated by a combination of progesterone and thyroid extract with the birth of thirty six living children, four of the children had congenital malformations and he thinks it possible that the use of progestin may carry on certain pregnancies that on account of congenital malformations in the embryo would have otherwise ended in abortion. No other author however seems to have reported any specially high incidence of deformity. Elden (1938) reported 8 cases of habitual abortion treated by progesterone in a total amount of from 10 to 44 I U in the first six months. There was only one failure which was attributed to an operative laceration of the cervix. Macgregor and Stewart (1939) reported its use in 22 patients none of whom had had fewer than two successive abortions and in whom prior to the progesterone treatment 65 pregnancies had resulted in only 10 live births. Of the 29 pregnancies during which progesterone was given 14 resulted in a living child at term. They give exceedingly large doses—5 to 10 or even 20 mgm twice weekly and consider that there is almost an air of the miraculous about the results reported by various observers on doses which are almost infinitesimal in comparison with the amount of progesterone produced in normal pregnancy. In all these 111 cases therefore the successes were about 82 per cent.

Thyroid Extract Good results have followed the use of thyroid extract though its mode of action is not understood. It is said that abortion is more likely to occur in women whose basal metabolic rate is low. One grain of the dried extract may be given daily throughout the whole of pregnancy either alone or with corpus luteum extract (progesterone).

(8) Defects in the Male Parent

Recent observations go to show that abnormalities in the spermatozoa may be not infrequently a cause of unsuccessful pregnancy. According to Kenneth Walker and B P Wiesner the morphology of the spermatozoa is more important than numbers or motility and abnormal forms *e.g.* variations in head length changes in the nucleus and the presence of immature forms may lead to habitual abortion or even the birth of monstrous infants. Several samples must be examined before the spermatozoa can be pronounced abnormal. From observations and experiments on

lower animals there is reason to believe that sexual excess or defective physical condition of the male may lead to an increased abortion rate

(4) Idiopathic Group

In this group no cause can be discovered for the repeated abortions or miscarriages. It is usual to ascribe them to some hormonal or vitamin deficiency these views being generally based on experimental results in rats or rabbits which are of doubtful applicability to women. The following are some of the methods of treatment that are adopted in these cases

General Measures The patient's habits should be enquired into and any gross errors in hygiene corrected (p. 51). In addition certain precautions are necessary. (a) It is advisable to stay in bed during the time when a period would have occurred if the patient had not become pregnant and for three days before. (b) Sea bathing and all violent exercises should be avoided such as bicycle riding, tennis and swimming. (c) Marital relations should be avoided entirely and (d) No drastic purgative such as castor oil should be taken.

Vitamin E Evans and Scott Bishop in 1922 found that rats that had been reared on a certain basic diet grew normally, ovulated and conceived but could not reproduce because the embryos invariably died and were resorbed. This was found to be due to loss of a substance to which the name vitamin E was subsequently given, and which is present in abundance in wheat germ, rice polishings and in green vegetables especially lettuce, spinach and water cress. The mode of action of this vitamin deficiency is still unknown but several suggestions have been made based on experimental and clinical observation. Mason suggests on the basis of experimental work that it is essential either for the maintenance of the normal physico-chemical state of the nucleus or for some phase or phases of cellular metabolism involved in the synthesis of the chromatin molecule and that it is particularly indispensable for those tissues in which cellular proliferation and differentiation are unusually rapid. Rowlands and Singer have shown that extracts from the anterior pituitary of rats fed on a diet deficient in vitamin E contain subnormal amounts of follicle stimulating and luteinising hormone (prolan A and B). This suggests that vitamin E deficiency acts through the pituitary gland. Injection of prolan A and B however did not prevent

the foetal resorption due to the deficiency. Prolonged vitamin E deficiency too causes hypothyroidism.

Considering the clear cut results of vitamin E deficiency in producing foetal resorption in rats it was inevitable that vitamin E preparations should be used in cases of human abortion and many series have now been reported. The preparation used is wheat germ oil of which there are several convenient preparations on the market e.g. Fertitol (Vitamins Ltd), Phytoferol (British Drug Houses), G. L. Wheat Germ Concentrate (Glaxo Laboratories) or the synthetic preparation Epheryl (Roche Products). It is usual to give one 3 or 5 minims capsule daily starting as early in pregnancy as possible and continuing till term. Much larger doses however are sometimes used and seem to be without any harmful effect. Shute for example states that small doses such as those above mentioned are quite inadequate and that sufficient must be given to reduce to normal the antiproteolytic power of the maternal serum. He gives an initial dose of 6 to 12 drams in the first twenty four hours and 1 dram daily thereafter. As the oil tends to deteriorate rapidly the preparation used should be one that has been biologically tested and standardized and it should be fresh and kept in a cool place. The earliest report on the clinical use of vitamin E was that of Vogt Möller (1933) who reported its use in 20 cases of habitual abortion 17 of the women giving birth to healthy infants at term. Watson and Tew (1936) reported on 100 patients treated for habitual and threatened abortion with 70 per cent success. Currie (1937) reported on the treatment of 37 patients who had had collectively 130 pregnancies and given birth to only 10 viable infants. The 37 women under treatment produced 37 living children 2 of them aborted there were two sets of twins and 4 children died in hospital from prematurity. He also treated 15 cases of threatened abortion with wheat germ oil and 14 of these went to term. The dose used was not less than 3 minims of wheat germ oil daily. Shute (1938) reported 89 per cent success in 29 cases. We have already mentioned the enormous doses used by him and it is noteworthy that he considers the small doses used by other workers as inadequate and probably useless. Taking all these reports together it is apparent that the use of vitamin E in habitual abortion is followed by success in approximately 75 per cent of the cases treated.

Vitamin C Lev has recently reported on the use of vitamin C

in habitual abortion. He gives sufficient by the mouth to secure a daily excretion of 250-300 mg. in the urine. Ten women were thus treated, all of whom had had at least two previous abortions, and all produced living children at term.

Normal Blood Serum. Sellheim in 1933 reported a series of 8 cases of habitual abortion treated by injecting serum of normal pregnant women who had negative Wassermann reactions. 10 c.c. were injected every fourteen days and there were seven successes. He also used it with success in a patient whose two previous children had died with jaundice shortly after birth. Rosenfeld (1938) treated 20 patients in a similar way but used 5 c.c. once weekly injected intramuscularly. 19 of the patients gave birth to normal living infants. Rosenfeld thinks that serum from a normal pregnant woman contains everything essential for the normal pregnancy. It did not seem to matter at what period of pregnancy the serum was collected. As normal pregnancy serum during the first two months contains large amounts of gonadotropic hormone injection of serum taken at that time might be followed by good results, but a more rational procedure would seem to be the injection of known quantities of the hormone itself.

Cold Baths. Reuter (1937) reported good results from the use of cold baths in habitual abortion, especially when the abortion appeared to be due to underdevelopment of the uterus. The patient is advised to have a bath filled with cold water ready by her bedside. On first waking in the morning she is to get into the bath, stay while she counts eight slowly and then, without drying herself, get into bed again. This may be continued throughout the entire pregnancy.

Conclusions. It seems therefore that a moderate and fairly uniform degree of success follows the use of a large variety of apparently unrelated therapeutic measures in idiopathic habitual abortion, and it is not surprising if doubts are beginning to arise in the minds of some observers regarding the real value of any of them. Malpas states that the abortion rate in any given population is about 18 per cent, and of these 18 he calculates that 17 abort from a casual or random cause such as trauma, infection, etc. and 1 from a recurrent cause. He also finds that the spontaneous cure rate, i.e., the likelihood of the next pregnancy continuing to term without any treatment is 78.4 per cent after one abortion. After two successive abortions it is 62 per cent.

and after even three successive abortions it is 2% per cent. Bishop in reporting a series of twenty two pregnancies treated by vitamin E or progesterone noted that in three of the series a second pregnancy proceeded normally to term without any treatment. Wilbur writes the necessity of vitamin E for normal embryonic growth in animals other than the rat and the mouse has not been established.

It is difficult to obtain proof that vitamin E is of value in treatment of habitual abortion in human beings. The American Council of Pharmacy and Chemistry have recently (1940) reported that the claim that vitamin E is of value in the prevention of habitual abortion cannot be accepted because of the lack of convincing clinical evidence.

The question could be settled definitely if alternate cases were treated as controls. This has been done during recent years at University College Hospital and to Dr. Muriel Boycott I am indebted for the following figures which give the position at the time of writing. Eighteen cases of habitual abortion have been treated all being patients that had at least two and most of them three spontaneous abortions and none having had a child. Of the eighteen cases eight were treated by progestin—all successful three were treated with vitamin E one of these being hospitalized for five months and all successful seven were controls all being untreated and of these two were hospitalized and five treated as out patients. All seven were successful and gave birth to a live child at term.

It is evident that many more such controlled series are necessary before a final judgment can be passed on the value in idiopathic habitual abortion of any of the specific methods of treatment above described.

REFERENCES

- ALLEN W. M. and CORNER G. W. *Amer Jour Physiol* 1909 88 340
 BISHOP P. M. F. *Guy's Hosp Rep* 1937 87 36"
 BOUIN P. et ANCEL I. *Jour de Physiologie et de Pathologie Generale* 1910 12 1
 BROWNE J. S. L., HENRY J. S. and VENNING E. H. *Amer Jour Obst & Gyn* 1939 38 9"
 COHEN S. L., MARRIAN G. F. and WATSON M. *Lancet* 1935 i 674
 CURRIE D. *Brit Med Jour* 1937 ii 1718
 ELDEN C. A. *Amer Jour Obst and Gyn* 1938 35 648
 EVANS H. M. and SCOTT B. HOPKINS K. *Amer Jour Physiol* 1939 23 63 396
 FALLS F. H., LACKNER J. E. and KROHN L. *J. A. M. A.* 1930 106 271
 FRAENKEL L. and COHN F. *Inat. In. Jena* 1901 XX, 91
 HERRICK W. W. and TILLMAN A. J. B. *S. G. O.* 1938 66 3"
 HUNTINGTON JAMES L. *Amer Jour Obst & Gyn* 1929 17 3"

- JONES, H W , and WEIL, P. G. *J A.M.A* , 1938, 111, 519
- KANE, H F. *Amer Jour Obst and Gyn* , 1930, 32, 110
- KAUFMAN, C. *Jour Obst and Gyn Brit Emp* , 1937, 44, 310
- KEIBEL, F , and MALL, I' P. 'Manual of Human Embryology' J B
Lipincott & Co , Philadelphia and London 1910 Vol I, 205
- KELLER, R , and ADRIAN, J. *Gynec et Obstetrique* , 1938, 38, 372
- LANE ROBERTS, C , SHARMA, A , WALKER KENNETH, and WIESNER B P
"Sterility and Impaired Fertility" Hamish Hamilton Medical Books,
London, 1939
- LEY, L. *Munch Med Woch* , 1937, 84 11 , 1814
- MACGREGOR, T N , and STEWART, C P. *Jour Obst and Gyn Brit Emp* 1939
- MALPAS, PERCY. *Jour Obst and Gyn Brit Emp* , 1938, 45, 932
- MALPAS, PERCY. *Jour. Obst and Gyn Brit Emp* , 1942 49, 65
- MASON, K E. *Amer Jour Anat* , 1933 52, 153
- MILLER, N I. *Amer Jour Obst and Gyn* 1922 4 398
- PILLMAN WILLIAMS, E C. *Lancet*, 1933, 11 , 878
- REUTER. *Fortschritte der Medizin*, 1937, 55, 201
- ROSENFELD, S S. *New York State Jour of Med* 1938 38 1 , 440
- ROWLANDS, I W , and SPICER, E. *Jour Physiol* 1936 86, 323
- SILLHEIM, H. *Zent f Gyn* , 1933, 57, 2226
- SHUTE, EVAN. *Amer Jour Obst and Gyn* , 1938, 35 240
- TAYLOR, H C , and SCADRON, E N. *Amer Jour Obst & Gyn* 1939 37, 963.
- VOGT MÖLLER, P. *Acta Obstet et Gyn Scand* 1933-34 13, 219
- WATSON, E , and TRW, W P. *Amer Jour Obst and Gyn* , 1936 31 352
- WILBUR, D L. *Archiv Int Med* 1938, 61, 323
- WILLIAMS, BRYAN. *Lancet*, 1938, i , 1168

CHAPTER XVI

HÆMORRHAGE IN LATE PREGNANCY

HÆMORRHAGE in late pregnancy is also known as 'ante-partum hæmorrhage'. By this is meant hæmorrhage from the genital tract occurring before the onset of labour and after the twenty-eighth week of pregnancy. The most common causes are placenta prævia (unavoidable hæmorrhage) and premature separation of the normally situated placenta (accidental hæmorrhage). In both the bleeding comes from the placental site and occurs because the placenta has been partly or wholly separated from its attachment to the uterus. Ante-partum hæmorrhage may also arise from such causes as uterine or cervical polypi, cancer of the cervix, cervicitis, varicose veins of the cervix, etc.

In clinical practice there are many cases of ante-partum hæmorrhage in which an accurate diagnosis is never made between unavoidable and accidental hæmorrhage. This is especially the case if bleeding has been slight and the patient has been treated expectantly. She may then go into labour spontaneously and deliver herself without any interference or any recurrence of the bleeding and therefore without complete investigation having been made. We hold therefore that cases of ante-partum hæmorrhage should be classified under four headings:

(1) Unavoidable hæmorrhage from placenta prævia, in which the attachment of the placenta to the lower uterine segment has been demonstrated by internal examination or in an X-ray picture.

(2) Accidental hæmorrhage from premature separation of a normally situated placenta demonstrated in the same way.

(3) Ante-partum hæmorrhage of doubtful origin in which no complete investigation has been made.

(4) Ante-partum hæmorrhage arising from extra-placental causes such as cervical or uterine polypi, cancer of the cervix, cervicitis, varicose veins of the cervix, etc.

For many years we have adopted this classification in our annual hospital reports. During the years 1939 and 1940 the following were the numbers classified under each of the above headings —

Unavoidable hæmorrhage 10, accidental hæmorrhage

antepartum hæmorrhage of unknown origin, 26, antepartum hæmorrhage due to extraplacental causes, 1

Placenta Prævia

Placenta prævia is much more frequent in multiparæ and especially in women who have borne a large number of children in rapid succession. In Comyns Berkeley's series of 4406 cases, 20.1 per cent. were in primigravide. It occurred, however, more often in the first than in any other individual pregnancy. Thus of the above series, 886 occurred in the first pregnancy, 750 in the second, 634 in the third, 506 in the fourth and 359 in the fifth. It is relatively more frequent in twin pregnancy as would be expected from the large size of the placenta. Our figures for the last ten years show that in about 10 per cent. of all the cases the placenta prævia was either complete or central and in the remainder partial. The frequency, taking all varieties together is about 1 in 1,000 pregnancies.

Ætiology. We know very little regarding the causes of placenta prævia. One explanation is that it is due to low implantation of the ovum, but why this should occur is not clear. It has been attributed to late development of the trophoblast, so that the early ovum is unable to embed itself in the decidua until it has travelled far from the internal os of the tube to the lower part of the uterus. This however would not explain its comparative rarity in primiparæ. The older writers invariably blamed 'chronic endometritis,' and this seemed to fit in very well with its greater frequency in multiparæ as in them endometritis was supposed to be common—a result of infection in childbirth. The modern view is that chronic endometritis is extremely rare, if it ever exists at all so this explanation is no longer fashionable. It is, however, possible that in multiparæ the interior of the uterus is smoother, the cilia less numerous, and the walls less closely in apposition, so that less hindrance is offered to the descent of the ovum. This is a very plausible theory and may at least explain some cases. Grösser, however, suggests that excessive ciliation, such as might be present in hyperplasia of the mucous membrane, may lead to placenta prævia by the too rapid passage of the ovum down the uterus. In 1888 Hofmeier advanced a new explanation¹ in which he was

¹ Hofmeier's theory had been anticipated long before by Robert Barnes. 'Why,' he says, 'should not the chorion at any part furnish the fetal

afterwards strongly supported by Kaltenbach. This was that in placenta prævia the placenta might be developed in part on the decidua capsularis (or reflexa as it was then called). Normally, of course the villi on the decidua capsularis atrophy after the third month (chorion læve) and the placenta is formed entirely from the decidua basalis (chorion frondosum). According to Hofmeier the capsular villi sometimes persist, possibly from abnormalities of blood supply and if they do so at the lower pole of the ovum they form a 'capsular placenta' which ultimately comes in contact with the decidua vera and fuses with it. It seems likely that this is the true explanation of many cases of placenta prævia though we know little or nothing as to why the capsular placenta forms. Penrose has recently carried out a statistical study of the influence of maternal age and parity on placenta prævia. The results suggest that increasing age is a significant factor in causing central placenta prævia whereas multiparity can be the chief cause in marginal and lateral cases.

Symptoms. The only symptom is hæmorrhage. Typically it is *causeless, painless* and *recurrent*. It may start during sleep, the patient awaking to find herself in a pool of blood. It is *causeless* in the sense that there is usually no history of preceding trauma nor evidence of pregnancy toxæmia, either of which may cause accidental hæmorrhage. The bleeding is not associated with abdominal pain as is the concealed variety of accidental hæmorrhage. If the bleeding occurs first during labour it will, of course, be accompanied by labour pains, and will indeed only occur during pains as it is then that a fresh area of placenta is being separated. In this sense the hæmorrhage is not always painless. If it comes on during pregnancy, however, it is painless as the placenta is then being separated by the rhythmic painless contractions of the uterus. Lastly, the bleeding always tends to recur until delivery is over, or until the whole area of placenta attached to the lower segment has been separated, and *the more complete the degree of prævia the greater is this tendency to recurrence of hæmorrhage*. The recurrence is due to separation

element? Facts seem to show that it may. The remarkable example I have just described is strong evidence. Further evidence may be drawn from the observation of specimens of extra uterine pregnancy. In such cases the ovum being lodged in an abnormal situation ill adapted to supply sufficient nutriment for the embryo it is not uncommonly found that the greater part or the entire surface of the chorion is developed into placenta. There is a well marked example of this in Guy's Museum. "The Physiology and Treatment of Placenta Prævia" by Robert Barnes London, 1898.

of fresh areas of placenta. The hæmorrhage in placenta prævia is practically always revealed none of it being retained behind the placenta or membranes as happens in concealed accidental hæmorrhage.

The time of first onset of the bleeding varies but it nearly always occurs before full term. Only 5 per cent of Pankow's cases had reached term when the bleeding began. It most commonly sets in after the 6th month and is seldom severe before the end of the 7th. Indeed it is common to restrict the term ante partum hæmorrhage to that occurring after the 28th week and to apply the term threatened abortion or 'threatened miscarriage' to any case in which bleeding occurs from the placental site before that time. The distinction is however only a clinical one and has no justification in the pathological sense. Many early abortions are due to placenta prævia and cases of fatal hæmorrhage from this cause have occurred as early as the 4th month. While however it should be clearly understood that there is no essential difference between 'ante partum hæmorrhage' and hæmorrhage occurring before the 28th week (the period of viability of the child) yet it is useful for clinical purposes to limit the term ante partum hæmorrhage to bleeding after the 28th week as before that time it is usually much less severe and dangerous.

The severity of the bleeding varies within wide limits. It may be slight or so severe as to be fatal at its first onset. Generally speaking the more complete the degree of placenta prævia that is the more nearly it approaches the central type then the earlier

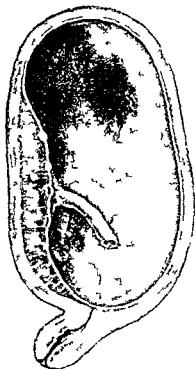


FIG. 99. Placenta prævia of second degree (Blum).

in the pregnancy the hæmorrhage sets in the more severe it is and the more likely it is to recur at frequent intervals. Thus if a very severe bleeding occurs at the 6th or 7th month it is likely that we have to do with the *complete* rather than the *partial* variety. There are however many exceptions to this rule and it is not uncommon to find that in complete or even central

cases the hæmorrhage occurs for the first time with the onset of labour at term.

Classification The following varieties of placenta prævia are recognised (1) The greater part of the placenta is attached to the upper segment and only the lower margin dips into the lower segment. This is best termed *placenta prævia* of the first degree. By some authors it is called

lateral placenta prævia but this is a bad term as it is differently understood by different writers and thus leads to confusion. (2) The edge of the placenta reaches the internal os — *placenta prævia* of second degree (Fig

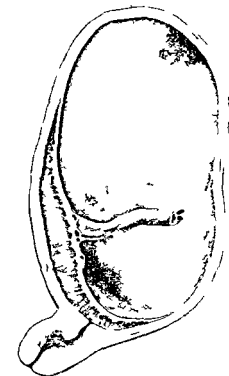


FIG 30 Placenta of third degree or complete placenta prævia (Bumm)

29) It is often called *marginal placenta prævia*. Berrv Hart gave to these two degrees the names *high dipping* and *low dipping* placentas respectively. The terms are good but they have never been universally adopted. (3) The placenta overlaps the internal os when closed but does not cover it entirely when fully dilated — *placenta prævia* of the third degree or *complete placenta prævia* (Fig 30). (4) The placenta is so low that its centre corresponds roughly with the centre of the

internal os and it therefore completely covers the os even when fully dilated—"central" placenta prævia (Fig 31) This variety is comparatively rare

Diagnosis The chief difficulty arises in distinguishing between unavoidable and accidental hæmorrhage The following points will assist —

(a) Placenta prævia occurs most often in women who have had a large number of children in rapid succession Primigravidae and multiparæ are about equally liable to accidental hæmorrhage (p 251)

(b) In accidental hæmorrhage there is nearly always evidence of chronic nephritis or of pre eclamptic toxæmia or essential hypertension In placenta prævia there is usually no such evidence

(c) The history of the hæmorrhage in placenta prævia is often typical—a painless causeless recurrent bleeding In accidental hæmorrhage on the other hand the abdominal pain is often excruciating when the bleeding is partly or wholly concealed there is often a causal pre eclamptic toxæmia and the bleeding is not necessarily recurrent

(d) In placenta prævia the abdomen shows no signs of concealed hæmorrhage It is neither hard nor tender and the foetal parts are easily felt Malpresentations are frequent and if the vertex presents the head is usually freely movable above the pelvic brim If the placenta is lying in front it can occasionally be felt above the pubic symphysis 'like a wetted bath sponge' (Spencer) intervening between the hand and the foetal head It must be remembered however that the placenta is often thin,

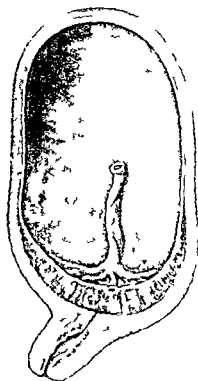


FIG 31 Central placenta prævia
(Baum)

and therefore less easily palpated than usual. The position of the uterine souffle is of no diagnostic value.

It should be remembered that though in placenta prævia the presenting part is usually high, fixation of the head in the pelvis does not always exclude placenta prævia. We have recently seen a striking example of that. The patient, a primigravida aged 33 was admitted to hospital on account of ante-partum hæmorrhage. There were no signs of toxæmia, but as the fœtal head was engaged deeply in the pelvis placenta prævia was not suspected. No vaginal examination was made and expectant treatment was carried out. Four days later, however severe hæmorrhage set in and on examination under anæsthesia the placenta was found to cover the internal os. It was of the thin membranous variety.

(e) Internal examination is usually necessary to make a sure diagnosis. *This should only be carried out in a hospital or similar institution where it is possible to have proper assistance and facilities and to take complete aseptic and antiseptic precautions, and only then in certain conditions (p. 224).* As severe bleeding may occur during this examination preparations should be made to deal promptly and efficiently with such an emergency, and the patient should be grouped beforehand and especially if a good deal of blood has been already lost a donor should be in attendance. To make a satisfactory examination a general anæsthetic is always necessary and the whole hand must be passed into the vagina. The patient should be prepared with the most careful precautions to ensure surgical cleanliness. The vagina should be ironed out (p. 177) using plenty of ether soap as lubricant, until it freely admits the hand which is passed up to the cervix. It will usually be possible to pass a finger through the internal os, when the placenta may be felt to cover it completely or merely to reach its edge or the lower margin may be felt an inch or two above it. There is usually no difficulty in recognizing the placenta. Blood clot may be mistaken for it, but is friable and readily breaks down under the finger, whereas the placenta is tough and fibrous

The internal os may, however be completely closed. We may then make an attempt to feel the placenta through the fornices. If the placenta is very low down the fornices may feel boggy and the presenting part is indistinctly felt. This method is however rarely satisfactory, especially if the breech is presenting. If the vertex is presenting it may be possible to feel with more or less

certainly the placenta like a "wetted bath sponge" between the finger and the hard head

It will be evident therefore that if the os is closed it may be impossible to feel the placenta, and we may then be left in doubt regarding the diagnosis. Fortunately, such cases are rare, and if the os fails to admit a finger the placenta prævia is not usually of more than the first degree and therefore not dangerous

(f) *X ray Diagnosis of Placenta Prævia* (see p. 343)

Influence on Pregnancy and Labour Malpresentations are frequent, as the low lying placenta prevents the head from entering the pelvis, and besides, many of the labours are premature. Pankow, amongst 914 collected cases found that 68 per cent were vertex, 21 per cent transverse, and 10 per cent breech presentations. *Hæmorrhages are frequent from the early months, and about 40 to 50 per cent of the deliveries are premature.* The labour pains are apt to be weak and infrequent. This is probably due to the loss of blood, which makes the uterine muscle atonic, and it may predispose to post partum hæmorrhage. The cervix, because of its softness and vascularity, is extremely friable, and on the smallest provocation tears like wet blotting paper, and a tear starting in the cervix readily extends upwards into the lower uterine segment. These tears are a frequent source of post partum hæmorrhage, and they may follow even spontaneous delivery. Another reason for the frequent occurrence of post partum hæmorrhage is that the lower uterine segment is unable to contract and retract properly after delivery, and bleeding from the placental site is therefore imperfectly controlled. The placenta is apt to be morbidly adherent because in the lower uterine segment the decidua is poorly developed and therefore fails to prevent the undue penetration of the placental villi into the muscular wall. Kronig states that manual removal is necessary in from 6 to 10 per cent of all cases, which is a good deal higher than in normal deliveries. Finally, there is in placenta prævia increased danger of sepsis on account of the interference usually necessary, because of the anaemia and diminished resistance due to loss of blood, and because the placental site is low down, and therefore very accessible to infection.

Prognosis Ante-partum hæmorrhage ranks fourth as a cause of maternal mortality in England and Wales. The chief causes of death are hæmorrhage and sepsis, while less often it results from rupture of the uterus, air embolism, etc. The chief causes of

fœtal death are asphyxia from separation of the placenta, delay in the birth of the head in breech deliveries, and prematurity. The following figures, which I have collected from the recent reports of eleven teaching hospitals in Great Britain, indicate the mortality in hospital practice. Of 3,103 cases of placenta prævia, complete and partial, the maternal mortality was 5.9 per cent, and the fœtal 54.2 per cent. Included in these were 2,432 cases of partial placenta prævia in which the maternal mortality was 4.4 per cent and the fœtal 52.2 per cent.; and 671 cases of complete placenta prævia with a maternal mortality of 11.8 per cent, and a fœtal mortality of 60 per cent. The maternal mortality from the complete variety is therefore nearly three times that from the partial. The striking figures of Stratz show how low the maternal death rate may be when patients are treated early, and by one who has mastered the technique of a particular method of treatment. Of 173 cases treated by himself, and mostly in private practice, the maternal mortality was 0.6 per cent and the fœtal 44 per cent. *The outlook for both mother and child would be considerably improved if patients were sent early to hospital, and especially if they were neither examined, packed, nor otherwise interfered with before admission.* This is strikingly shown by Schweitzer, who found that the maternal death rate from sepsis in patients who had been sent to hospital without a vaginal examination having been made was nil. In those who had been examined *per vaginam*, but not otherwise interfered with, it was 2 per cent.; in those who had had a vaginal pack inserted it was 6 per cent., while it was 11 per cent in those who had other internal manipulations. This experience could be duplicated in every other large clinic. *Especially dangerous is the vaginal pack*, as it is rarely possible outside hospital to insert it with due regard to asepsis, and at best blood clot gathers above it, and forms an ideal culture medium.

Recurrence of placenta prævia is very rare, but Fitzpatrick has recorded a case in which it recurred five times in consecutive pregnancies. The high incidence of fœtal deformity is referred to later (p. 237).

Treatment. It is necessary before considering treatment in detail to lay down some general principles.

(1) The maternal mortality is much higher in domestic than in institutional practice. The chief reason for this is that the surroundings of the patient in her own home are unsuited for any

but the simplest operative interference, neither are facilities at hand for such life saving measures as blood transfusion. Treatment, too, often calls for special manipulative dexterity, and a matured judgment that can only be acquired by those who handle large numbers of cases.

(2) Delay in treatment may seriously prejudice the chances of success.

(3) As hæmorrhage is the chief cause of maternal death, every effort should be made to prevent loss of blood before, during and after delivery. Most of the fatalities occur from post partum hæmorrhage, which in itself may be slight, but is enough to kill a patient who has already bled severely before delivery.

(4) As the second most frequent cause of death is sepsis, every effort should be made to avoid trauma which predisposes to sepsis, to reduce internal manipulations, including vaginal examinations, to a minimum, and to carry out those that are essential with the most strict regard for antiseptic principles.

Domiciliary Treatment. From what has been said above it will be evident that the first onset of "warning hæmorrhage" however slight, should be the signal for immediate removal of the patient to a hospital or similar institution. Before doing so no vaginal examination should be made and no pack inserted. It is impossible to insert a pack properly, so as to be of any value in controlling hæmorrhage, unless a general anæsthetic has been given. Even in institutional practice it is almost impossible to insert it without causing sepsis, and this risk is much greater in domiciliary practice. Besides, the insertion of a pack before admission seriously limits the choice of treatment available to the surgeon when the patient eventually comes under his care.

Neither should a vaginal examination be made in the patient's home. Unless the whole hand is inserted into the vagina, which can only be done under an anæsthetic, little information is gained, as the cervix is usually too high to insert a finger. Secondly, vaginal examination, and especially the passage of a finger through the internal os, may lead to serious hæmorrhage, which may be difficult to control. Like the vaginal pack, the vaginal examination limits the choice of treatment, and increases the risk of sepsis should Cæsarean section be adopted.

Before moving the patient a hypodermic injection of morphia should be given, it is well also to apply a tight abdominal binder, which should come well up over the fundus, and push the fundus

downwards as much as possible, in the hope that the presenting part may press on the bleeding placental site. A vulval pad and perineal bandage should then be applied.

Institutional Treatment On admission the patient should be grouped, and her husband should sign an operation slip. A blood donor should be obtained, and in a serious case should have reached the hospital before treatment begins—that is, if delay is permissible in the patient's interest.

The question of diagnosis will first arise. It is necessary to find answers to the following questions: (a) Is the case one of placenta prævia or not, and if so, what is its degree? (b) What is the size of the os? (c) Is the patient in labour or not? The general condition, including the pulse and blood pressure, should be noted and if there is time it will be well to have a red cell count and hemoglobin estimation done, as they give accurate information with regard to transfusion requirements.

In the section on diagnosis the information, limited in extent, to be gained from a consideration of the history and from external examination has been discussed. This information is never quite conclusive, and a vaginal examination is necessary before a diagnosis can be established.

Here we hold strongly that *if the bleeding has been slight a vaginal examination by the finger is unnecessary*. A Sims or bivalve speculum should be passed and the cervix inspected to exclude such rare causes of bleeding as cancer of the cervix, mucous polypus or varicose veins of the cervix. If this examination is negative the patient should remain under observation in hospital and be treated expectantly. Should bleeding become severe, or continue, or recur more than twice or thrice in spite of rest in bed and sedatives, a vaginal examination with a thorough exploration of the exact state of matters must be carried out. For this purpose the patient should not be examined in the ward bed, but should be removed to the operating theatre. Full preparation should always be made for any treatment that may be found necessary, including blood transfusion, and even for Cesarean section, unless the patient is so gravely infected that abdominal delivery is contra-indicated. The operator is gloved and masked. A general anæsthetic is given, and the parts, including the abdomen, prepared. The vagina is douched and then ironed out (p. 177), the hand being well lubricated with ether soap (which is best poured into the vagina), until the

whole hand can be inserted. The state of the cervix is noted—whether dilated or not. If dilated the forefinger is gently passed through. The placenta may or may not be felt overlapping the internal os or approaching or reaching its edge. If not the finger should be carefully passed round the part of the lower uterine segment within reach. With the whole hand in the vagina it will usually be possible to reach upwards to a distance of 3 inches above the internal os and thus reach the upper margin of the lower segment. If the placenta is not felt the case is probably one of accidental hæmorrhage and should be treated accordingly (p. 254). If the edge of the placenta is felt care should be taken not to separate it as this always leads to serious bleeding and all unnecessary blood loss must be avoided. Treatment should then be carried out along the lines laid down subsequently (p. 27).

What should be done if the os is closed so that it does not admit a finger? We believe the best treatment here to be Cæsarean section provided it is not contra indicated by previous interference and the pregnancy has reached twenty eight weeks—that is that the case is one of ante partum hæmorrhage as defined above (p. 214). Especially is it desirable to terminate pregnancy without delay if the vaginal examination has caused much fresh bleeding for it is then likely that the placenta overlaps the internal os. The alternative to Cæsarean section is the vaginal pack but it is doubtful whether except in very exceptional circumstances the use of this septic and usually ineffective appliance should be perpetuated.

The Place of Expectant Treatment. Has expectant treatment any place in the treatment of placenta prævia? We believe that it is often advisable. If for example the bleeding has been slight and the patient is not in labour and especially if the child is not yet viable—that is of less than thirty five weeks development. The patient must however remain under constant supervision in a hospital or similar institution where there is medical help on the premises or not more than five or ten minutes away constantly available and so skilled as to be competent to carry out any treatment necessary including Cæsarean section. *The sister in charge should be warned of the danger and should clearly understand that help is to be summoned at once should bleeding or labour pains start.*

If the patient is unwilling to remain under this close supervision the danger should be pointed out to her and her husband. If as

very seldom happens when the risks are fully explained, they insist on disregarding advice, what should be our attitude? We are, of course, within our rights in declining further responsibility. But there is still another alternative, namely, to offer to carry out a complete examination under anæsthesia by the method above described (p 224), and to get permission to proceed at once to Cæsarean section should this be thought advisable, *i.e.*, if the placenta is found to overlap the internal os, or to be within easy reach, or should the vaginal examination lead to considerable hæmorrhage, in itself an indication that there is a severe degree of placenta prævia. On the other hand, if the placenta is not within easy reach, and if the examination causes no hæmorrhage, the patient may be allowed to go home with a promise to send at once should bleeding recur. If this alternative is declined nothing further can be done, and in hospital it is usual to get the patient to sign a form stating that she is going home against medical advice.

A suitable routine for expectant treatment is as follows. The patient is put to bed and given morphia hypodermically. As a rule this does not need to be repeated but rest in bed should be enjoined for a week after all bleeding has ceased. After that she may be allowed up for a short time daily. Labour may be allowed to come on spontaneously, but if the patient is an elderly *primigravida*, or for some other reason demands a living child Cæsarean section may be undertaken at any time after the end of the 36th week. Especially is this advisable if there is reason to believe that the degree of placenta prævia is a severe one, if, for example, there have been during the time of waiting small recurrent hæmorrhages, or if there is a malpresentation, or if, though the vertex presents, the head does not enter the pelvis, because it rarely does so if much of the placenta is in the lower uterine segment. The nearer such a patient approaches to term the greater is the risk of serious hæmorrhage starting usually with the onset of labour pains, and it is far better to forestall such an event by a planned operation.

From what has been said above it will probably be evident that the expectant treatment of a severe degree of placenta prævia is always a proceeding fraught with anxiety. Only those who have experienced it can realise *with what suddenness most alarming bleeding may start, and how rapidly the patient may become exsanguine*. Such a patient must therefore be most closely

watched, and it is necessary to emphasize again that the nurse in attendance should be warned to send immediately if hæmorrhage or labour pains start, and that the medical attendant must be in a position to reach the patient's side within, at most, five or ten minutes. *The responsibility placed on all those who have to treat such a case expectantly is a very heavy one, and should never be undertaken unless these rigid conditions can be fulfilled.*

It should be observed that, in what has been said in the foregoing paragraphs we have not advocated expectant treatment in a case in which placenta prævia has been diagnosed. All that is advocated is expectant treatment of ante partum hæmorrhage, for as a complete examination has not been made, a diagnosis has not yet been reached between unavoidable and accidental hæmorrhage. It is hardly necessary to point out that expectant treatment in these cases means that occasionally one will treat in this way patients who have complete placenta prævia. We believe however, that this is a safe procedure provided the precautions mentioned above are taken and the limitations laid down are not transgressed.

Active Methods of Treatment. Active treatment should be resorted to in all cases except those included in the group alluded to above as suitable for expectant methods. The following are the methods available —

- (a) Rupture of membranes
- (b) Willett's scalp traction forceps by which weight traction is applied to the scalp
- (c) Vaginal pack, either alone or followed by version and bringing down a foot, or by insertion of a hydrostatic bag when the os is sufficiently dilated
- (d) Compression of the placenta by the half breech by bringing down a foot in breech presentations, or after podalic version in vertex or shoulder presentations, the version being effected by either the external, bipolar or internal methods
- (e) Hydrostatic bag with weight attached
- (f) Cæsarean section

The first five methods aim at controlling hæmorrhage by exerting pressure on the portion of the placenta attached to the lower uterine segment. The torn sinuses in the wall of the uterus are thus compressed through the placenta, and hæmorrhage is prevented. These methods also tend to hasten delivery, and this is desirable up to a point, as the bleeding is always liable to recur

until the uterus is empty. It is undesirable, however, to hasten delivery too much, because, in the first place unless dilatation takes place slowly the cervix is apt to be badly torn, with the most serious results in the causation of post partum hæmorrhage and shock, secondly, because slow delivery gives time for recovery from blood loss and shock, and for the use of restorative measures, such as blood transfusion.

Non Interference during Labour. Many cases of placenta prævia seen for the first time in labour require no treatment whatever. They are mostly those in whom hæmorrhage has been slight and has ceased when the patient is first seen, the placenta prævia being usually of the first degree only. With the spontaneous rupture of the membranes the presenting part comes down on to the bleeding point and compresses it (thus may be aided by a binder), labour then ending spontaneously and without further bleeding. This was the method of termination in 18 per cent of 3103 cases that I have collected from the reports of eleven teaching hospitals in Great Britain, the maternal mortality being 2.7 per cent, and the foetal 34 per cent. Eight per cent of Munro Kerr's cases ended thus, with a maternal and foetal mortality of 2.6 per cent and 39.4 per cent respectively. We shall now consider the active methods of treatment separately.

Rupture of the Membranes and Application of a Tight Binder. The binder should be applied so as to reach well up over the fundus and press the presenting part downwards on to the placental site. This treatment is ideal in *placenta prævia of the first or even of the second degree (margin reaching the internal os), if the hæmorrhage has not been severe, and good pains are present and the os dilating.* The results for mother and child are excellent, partly because it involves little interference. In 3103 cases of placenta prævia collected from the reports of eleven British teaching hospitals this was the method of treatment in 13 per cent, the maternal mortality being 2.1 per cent and the foetal 43 per cent. Stratz in sixty-three cases had no maternal death, and a foetal mortality of only 11 per cent.

Willett's Scalp Forceps. This instrument was introduced in 1924 by J. A. Willett. It is a modification of de Martell's surgical scalp forceps with the length increased. As recommended by Willett its length was 74 inches, but its shortness made it somewhat difficult to apply if the head was high up. The newest form, therefore, measures 12 inches (Fig. 32). It can be applied as soon as

the os admits a finger. "Preferably an anæsthetic is given, the membranes are ruptured with the forceps, which, with the blades closed, are passed through the os till the head is reached. The blades are then separated, and, pressing on the scalp, closed, when a grip on the scalp will be obtained. A weight, varying from 1 to 2 lbs., hanging over the end of the bed, is applied to the handles by means of a tape. Nothing further is done until the head is in the vagina, when the forceps are removed and the patient is allowed to deliver herself without further interference" (Willett). Lacey found that a weight of $1\frac{1}{2}$ lbs gave the best results.

This method has several advantages. The forceps can be applied when the os admits only one finger, an amount of dilata-

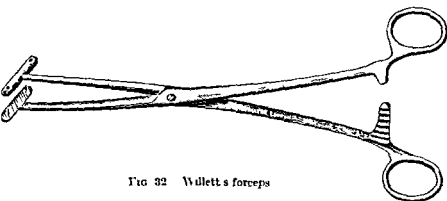


FIG. 32. Willett's forceps.

tion that would not allow the extraction of a foot, it involves, too, a minimum of interference, and besides the child is saved from the dangers incident to breech delivery. It is most easily applied when the placenta does not entirely cover the os, as it is then only necessary to rupture the membranes and grip the scalp. If the placenta covers the os it is necessary either to tear through the placenta or to go round its lower edge, but as the same procedure has to be carried out in performing bipolar version and bringing down a foot, a complete placenta prævia should not be an absolute contra indication to its use. As a matter of fact, however, the Willett's forceps is seldom used in complete placenta prævia. Thus in the series of cases of placenta prævia previously referred to (p. 228) that I have collected from hospital reports, 232 were treated by Willett's forceps, but only seven of these were of the complete variety. The maternal mortality in this series of 232

Kerr's results were similar—11·3 per cent and 9·4 per cent respectively. The truth seems to be that, while moderately good results sometimes follow the use of the pack provided it does not become necessary afterwards to carry out further treatment involving internal manipulations should version become necessary because of continued hæmorrhage the maternal mortality at once becomes extremely high. This is further forcibly illustrated by the

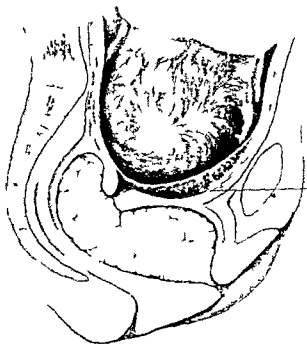


FIG. 33. The vaginal pack in placenta prævia (Bumm)

series collected by me from hospital reports (p. 228). 183 cases of placenta prævia were treated by pack alone with a maternal mortality of 10 per cent, while 85 were treated by pack followed by version and a maternal mortality of 20 per cent.

It will be evident therefore that the pack should be used as little as possible. Personally I believe that it should have no place in treatment except in the rare cases where there is the following combination of circumstances: severe hæmorrhage with a closed os in a patient not in labour, and in whom Cæsarean section is contra-indicated or rejected on account

which makes a fairly efficient substitute. It is improved as a packing material if it is unrolled and steeped in the lysol solution (1 dram to a pint of boiled water) or in Dettol 10 per cent and then wrung as dry as possible before insertion. The pack, of whatever material it is composed should be removed in about eight hours and should not be left longer than twelve hours. After its removal a warm antiseptic vaginal douche should be given.

Bipolar Version followed by bringing down a Foot
This method was introduced by Braxton Hicks in 1860. As it can be carried out when the os admits two fingers it was a great advance on the internal version till then practised which entailed either manual dilatation of the cervix or waiting till it had dilated spontaneously. In the following account of the operation I follow closely Braxton Hicks' original description. Suppose the face is to the right and the membranes intact. The hand is introduced as far as possible into the vagina

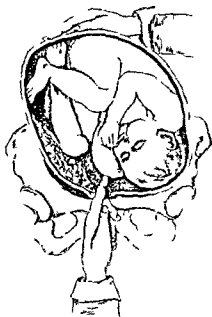


FIG 33. Combined external and internal (bipolar) podalic version. Second step (Braxton Hicks).

and far enough to reach a finger's breadth within the cervix. Sometimes it requires the whole hand; sometimes three or four fingers will be sufficient in the vagina. Having clearly made out the head and its direction, whether to one side or the other of the os uteri, the external hand is placed on the fundus and the breech is pressed down towards the right side. As it recedes, so the hand follows it by gentle palpation, while at the same time the internal hand pushes up the head in the opposite direction (Fig. 34) so as to raise it above the brim. When the breech has arrived at about the transverse diameter of the uterus, the head will have cleared the brim and the shoulder will be opposite the

for the post partum hæmorrhage that is especially liable to occur in placenta prævia

The results from bipolar version without preceding vaginal pack are moderately good for the mother but bad for the child. By far the best are those of Stratz who in 110 cases, all treated by himself by this method had a maternal mortality of 0.9 per cent and a foetal mortality of 64 per cent. This maternal mortality has never so far as I know, been equalled by any method of treatment



FIG. 77 Foot brought down in placenta prævia (B. Minn.)

suitable for severe cases, and is evidence not only of what can be accomplished by bipolar version but also of the importance of expert treatment. It will be observed, however, that the foetal mortality is very high.

External Version and bringing down a Foot It is usually possible to carry out podalic version by external manipulations alone especially as the foetus is often premature. As it is easier than the bipolar method it should always be tried first, all the more so as it is advisable to reduce internal manipulations to a minimum. When the breech has been made the presenting part,

one or two fingers are passed through the internal os, the membranes ruptured, the ankle seized and the foot brought down (Fig 37)

Internal Podalic Version followed by bringing down a Foot This is only possible when the os is large enough to admit the whole hand. Its use is therefore limited to cases in which the os is at least half dilated, and even then external version is preferable if it can be carried out, or bipolar version if it cannot, as they entail less intra uterine manipulation.

Hydrostatic Bag The bag is introduced inside the amnion, filled with sterile water, and a weight attached. It excites labour pains and when the os is large enough the bag is expelled into the vagina. Delivery is then effected by internal version, forceps, etc. or may, if hæmorrhage has ceased, be allowed to occur spontaneously. The maternal mortality is much the same as from bipolar version, but the foetal mortality is considerably lower. Therefore some prefer the bag to bipolar version when the condition of the foetus is good. One of its disadvantages is that it is liable to displace the presenting part, another that version is often necessary because of continued hæmorrhage after the bag is expelled. The hydrostatic bag is now little used in British hospitals. Thus of the 3,103 cases of placenta prævia that I have collected from the reports of eleven British teaching hospitals it was used in only 20, 17 of which were cases of partial placenta prævia and 3 complete. The maternal mortality in the 20 cases was 5 per cent. and the foetal 66 per cent.

Cæsarean Section Since the treatment of placenta prævia by abdominal Cæsarean section was first advocated by Lawson Tait in 1890, and was referred to as "the last resource of a great surgeon who had forgotten his obstetrical training," its use has advanced steadily in favour. Its increasing popularity is not surprising in view of the fact that although the maternal mortality can be reduced by early treatment and the best conservative methods to a reasonable figure, the foetal mortality has been but little improved, and is still even in the most favourable circumstances, as high as 40 to 50 per cent. Cæsarean section alone offers much hope of improving that, and it gives to the child the best possible chance of survival. All the conservative methods that involve the control of bleeding by pressure on the placenta, whether by breech, foetal head or hydrostatic bag, must of necessity endanger the life of the child by asphyxia. Even in treatment by Willett's

forceps this danger is unavoidable. It must, however, be remembered that in many cases the foetus has been killed by placental separation before treatment is begun, and that a large proportion of the remainder are too premature to survive birth. We can never hope, therefore, to obtain a really low foetal mortality even by Cæsarean section. From an analysis of our own cases I place this unavoidable foetal death rate at 25 per cent. There is reason to believe, too, that foetal deformities, especially cranial and spinal defects, such as anencephaly, hydrocephalus, and spina bifida, are particularly prone to occur in placenta prævia. Greenhill, in 1923, found fifteen recorded cases and added six more. He believes that the malformations are due to the faulty relations between the placenta and the foetus, giving rise to arrests in development, and that it is advisable where Cæsarean section is contemplated to try to ascertain by X-ray examination whether the foetus is normal.

What hope does Cæsarean section hold out of improving the prognosis for the mother? We have already considered the remarkable results obtained by Stratz in 173 cases treated by conservative methods—one maternal death from pulmonary embolism (0.6 per cent). He considers Cæsarean section only indicated when the mother demands a living child or when there are other complications present, such as contracted pelvis. Probably such results, so far as the mother is concerned, could not have been improved by Cæsarean section, and it is doubtful if they could have been equalled. But no other obstetrician has approached Stratz's results, though those of Jellett (3.6 per cent in 138 cases) are good. Cæsarean section reduces loss of blood and shock from manipulation to a minimum and it also obviates the severe laceration of the cervix, which in placenta prævia may occur even in spontaneous delivery. Post partum hæmorrhage from that source is thereby avoided, and this may be a very important consideration when the patient is already exsanguine.

In 495 cases that I have collected from hospital reports the maternal mortality averaged 4.5 per cent. Examination of detailed figures must lead one to doubt whether the more general use of Cæsarean section in cases of *partial* placenta prævia would give better results for the mother than those obtained by conservative measures. For the child the results would certainly be better. In *complete* placenta prævia, however, the case is entirely different, for by far the best results for both mother and child are obtained

by Cæsarean section. In 270 cases treated thus collected by me from the records of eleven British teaching hospitals the maternal mortality was 2·2 per cent and the fetal 24·5 per cent figures which should be compared with 14·6 and 86 per cent respectively in cases treated by version.

It seems then that Cæsarean section should be reserved for a few selected cases only. Many patients when admitted to clinics are unsuited for any but the most conservative treatment. Chief among these are patients who are grossly infected including nearly all those that have been packed before admission. Sometimes a patient when first seen has already lost so much blood as to be *in extremis* and it may be felt that interference *per vaginam* or even a vaginal examination is likely to be attended by a further severe hæmorrhage that may prove fatal. In such circumstances classical Cæsarean section may be the best way out of the difficulty, especially if a blood transfusion can be given before operation or as soon as the placenta is removed. Even when such cases have been previously packed a lower segment Cæsarean section may still be done. As it is important to prevent further loss of blood, as soon as the uterus is opened the edges of the incision should be grasped by Allis forceps or the special forceps designed by Green Armytage and the fœtus and placenta then removed. It is good practice to push the placenta down into the vagina provided the os is sufficiently dilated. The abdomen should be drained. Additional safety may be obtained by insufflating the interior of the uterus especially its lower part in the region of the cervix, after removing the placenta with sterile sulphanilamide powder.

The indications for Cæsarean section may therefore be defined as follows —

(1) Cases with severe ante-partum hæmorrhage when the os is closed. The only alternative is the vaginal pack, which should be discarded except in the exceptional circumstances detailed above (p. 231).

(2) If the os does not admit two fingers and the placenta entirely covers it. The alternative here is Willett's forceps but it is undesirable to apply this through the placenta and its use is in any case always attended by a risk of serious infection (p. 230).

(3) Placenta prævia of any degree in an elderly primigravida or in any woman who demands a live child if the os is less than half dilated and provided the fœtus is viable (over thirty-five weeks) and the patient not infected.

(4) Cases complicated by disproportion or other condition likely to lead to obstructed labour

(5) Patients in *extremis* where it is felt that manipulations *per vaginam* or even a vaginal examination, may be attended by a further severe hæmorrhage that may prove fatal

Management of the Third Stage After the child is born the most careful watch must be kept for post partum hæmorrhage. It cannot be too strongly emphasised that *the great majority of the cases that end fatally from hæmorrhage do so because of post partum hæmorrhage*, and that even a small post partum loss which would be of no account after a normal labour may be enough to turn the scale against a patient already severely depleted by ante- and intra partum hæmorrhage. All preparations should therefore be made for the immediate and energetic treatment of post partum bleeding including pituitrin ergometrine (which as Chassar Moir advises may be injected direct into the uterus through the abdominal wall) hot douches sterile gauze for packing suture needles and catgut and blood transfusion. If the medical attendant is wise he will control the fundus himself instead of leaving it to an assistant. If hæmorrhage takes place in spite of the uterus being well contracted, the cervix must be exposed by a speculum and examined. If it is torn and bleeding a continuous locked catgut suture of double No. 1 catgut should be inserted immediately. As however the placental site is in the lower uterine segment which does not contract and retract well it may bleed freely even when the uterus seems well contracted. In such cases a hot intra uterine douche at 118° may be of the greatest value and above all *humane* compression. Expression of the placenta by Crede's method is unnecessary as long as there is no hæmorrhage but should this occur it must be expressed at once. If attempts at expression fail it must be manually removed.

The Value of Blood Transfusion The prophylactic and therapeutic value of blood transfusion should be constantly kept in mind by those who have to treat cases of placenta previa. About 65 per cent of the patients who die, do so because of hæmorrhage, and most of these deaths could be prevented by the employment of measures directed to the replacement of the blood lost. Its great value has been strikingly shown by Bill, who chiefly by means of it reduced his maternal mortality from 11 to 1.78 per cent, while 12.4 per cent of his cases required and received blood transfusion. He points out that most patients die of

post partum hæmorrhage, because the anæmia consequent on ante partum bleeding produces an atonic state of the uterus, so that it is unable to contract properly after delivery. To prevent this he gives blood transfusion before delivery to every patient whose red cell count is below 3,000,000 and blood pressure below 90 systolic and 60 diastolic. He advises that the transfusions should be in the hands of a member of the staff who is an expert in the technique and in the blood reactions. We have already seen that the patient should be grouped on admission and that a donor should, in every serious case, be on the premises before treatment is begun. If, for any reason, blood transfusion is impossible saline or gum saline infusion will be of value.

The following summary of treatment emphasises the main points —

Summary of Treatment of Placenta Prævia If a patient has ante partum hæmorrhage, however slight, she should be admitted to hospital immediately. No vaginal examination should be carried out before removal and no vaginal pack inserted. A hypodermic injection of morphia should be given before removal, and a tight abdominal binder, coming well above the fundus should be applied together with a vulval pad and tight perineal bandage.

On arrival in hospital the patient should be grouped. The subsequent treatment will depend on the severity of the bleeding.

I Bleeding slight (a) Not in labour —

Expectant treatment (rest in bed and sedatives)

No vaginal examination by the finger is to be made unless bleeding becomes severe. A speculum should be passed to exclude extra placental causes of bleeding such as cancer of the cervix, mucous polyp, etc.

Keep under supervision until delivered.

(b) In labour —

No interference may be necessary. If bleeding becomes severe, treat as below (under II).

II Bleeding severe Active treatment at once

Patient to be grouped before treatment begins, and a donor should, if possible, have reached the hospital.

All preparations to be made for Cæsarean section and for treatment of ante partum and post partum hæmorrhage.

Examine in operating theatre under general anæsthetic with whole hand in vagina.

Methods of Treatment

A *Cæsarean Section* (i) If os does not admit a finger

(ii) If os does not admit two fingers, and placenta entirely covers it or is within easy reach

(iii) In an elderly *primigravida* or any patient who demands a living child if fœtus alive and viable especially if placenta easily reached and os less than half dilated

(iv) Cases complicated by disproportion or by any other condition likely to lead to obstructed labour

(v) Occasionally patients in *extremis* may be so treated if it is felt that vaginal manipulation might cause a further and possibly fatal hæmorrhage Transfusion should be carried out during the operation

In other cases choice lies between the following —

B *Willest's Scalp Traction Forceps* We have already given reasons why we consider this instrument should not be used (p 230)

C *Pressure by Half Breech on Bleeding Point* This can be used when the os admits two fingers

(1) *If Vertex presenting* (a) External version rupture membranes pull down foot and attach gauze for traction

(b) If external version impossible bipolar version rupture membranes extract foot etc as above

(c) If external and bipolar version impossible and os three-quarters dilated do internal version and bring down one foot

(2) *If breech presenting* rupture membranes and pull down foot

In all cases delivery to be left to nature till breech born and occupy interval in restoring patient—blood transfusion etc

D *Rupture of Membranes and Tight Binder* This is good treatment if the following conditions are present *together* —

(1) Placenta not over internal os

(2) Strong pains present

E De Ribes' hydrostatic bag never to be used

Third Stage The placenta is not to be expressed by Credé's method unless there is bleeding

In all cases guard carefully against post-partum hæmorrhage which is the most frequent cause of death Blood transfusion to be done in all cases in which blood loss appears serious It can often be done with advantage after treatment and before delivery Post partum bleeding often comes from a torn cervix It should be exposed and sutured

REFERENCES

- BARNES R *The Physiology and Treatment of Placenta Prævia* ' London, 1858
- BERNELLY COMANS *Jour Obst and Gyn Brit Emp*, 1936 43, 393
- BILL A H *Im Jour Obst and Gyn* 1927 14 523
- BROWNE F J *Proc Roy Soc Med*, London 1939, 32, 1209
- FITZPATRICK E H *Lancet* 1889, 1, 678
- GREENHILL J P *S G O* 1923 36, 22"
- GROSSER O *Frühentwicklung Eihautbildung und Placentation.*" München 192"
- HART D BERRY *Guide to Midwifery* ' Heinemann London 1912
- HICKS J BRAXTON *Trans Lond. Obst Soc*, 1864 5 219
- HOFMEIER M. *Handbuch d Geburtshilfe (F r Winckel)* Wiesbaden 1904
Bd II Heft II 1185
- JELLETT H *Lancet* 1910, 1 1271
- KERR J M MUNRO *Trans Edin Obst Soc* 1924-5 45, 71
- LACEY F H *Brit Med Jour*, 1929, II, 52"
- MOIR CHASSAB *Proc Roy Soc Med*, London, 1939 32, 928
- PANKOW O *Biologie u Path des Weibes* (Halban und Sertz) Berlin and Vienna 1926-7 VIII, Teil I 1
- PENROSE L S *Jour Obst d Gyn. Brit Emp*, 1939, 46, 645
- SCHWEITZER *Zent f Gynäk* 1929 46, II, 1869
- SPENCER H R *Trans Lond Obst Soc*, 1889, 31, 203
- STRAITZ C H *Zeitsch f Geb u Gynäk* 1915, 76, 713
- WATSON B P and MILLER, DOUGLAS A *Trans Edin Obst Soc* 1924-5 45 55
- WILLETT J A *Proc Roy Soc Med*, 1924-5 18, 90

CHAPTER XVII

HÆMORRHAGE IN LATE PREGNANCY—(*continued*)

Accidental Hæmorrhage

Syn Abruptio placentæ, Utero placental apoplexy

ACCIDENTAL hæmorrhage is due to premature separation of the normally situated placenta. The term "accidental hæmorrhage" was first given to it in 1775 by Edward Rigby, of Norwich, because he believed that it was due to 'some accidental circumstance'. He was the first to distinguish clearly between this form of hæmorrhage and that due to placenta prævia, which he termed "unavoidable hæmorrhage."

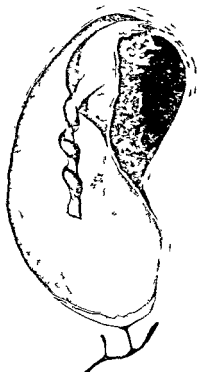
Pathological Considerations Accidental hæmorrhage may be external (revealed) or internal (concealed). In the former the blood escapes externally. In the latter it collects between the placenta or membranes and the uterine wall necessarily separating the placenta or membranes from their attachment and forming a retroplacental clot (Fig. 38). The hæmorrhage may be entirely external or entirely internal (concealed) or starting as a concealed hæmorrhage it may later become revealed, some of the blood or serum that has collected behind the placenta or membranes finding its way, owing to the onset of uterine contractions, through the cervix into the vagina.

In the concealed variety there are, in addition to the retroplacental clot, changes in the uterine wall that have important bearings on treatment. The muscle, especially in the region of the placental attachment, is infiltrated by extravasated blood that ploughs up and more or less seriously injures the muscle fibres, the individual fibres being torn and dissociated from each other. The extravasated blood may be visible as large ecchymoses on the peritoneal surface. Sometimes too the peritoneum is extensively fissured and the peritoneal cavity may contain free blood. Largely in consequence of these injuries the muscles of the abdominal wall are in a state of spasm and the patient suffers from shock, which is the most outstanding clinical feature and dominates treatment. Partly, too, because of this injury, partly because of the sudden distension which it undergoes when blood clot collects behind the placenta, the uterus is often atonic, and

therefore unable to contract and retract as well as it should. No doubt the absence of contractility is partly due also to shock. The most serious cases are those in which the power of con-

traction is so far lost that the hæmorrhage is entirely concealed. Fortunately, these are rare, but when they occur the mortality is extremely high.

To this hæmorrhagic infiltration of the wall of the uterus Couvelaire, in 1911 gave the name of *apoplexie utero placentaire*. He traced the blood to capillaries that had given way. In addition to the hæmorrhage œdema is a striking feature the fluid being coagulable and of an albuminous nature. Thrombosis of veins has been described by several authors but doubt exists as to whether it is pathological or merely the normal thrombosis that occurs in the uterine veins after the placenta has been separated. The dissociated muscle fibres



Hæmorrhage in the Appendages The extravasation of blood in utero placental apoplexy is not limited to the uterus. The broad ligament is often the seat of extravasation which may be extensive enough to form a large hæmatoma, and similar hæmorrhages are often present in the ovary and tube.

Minute hæmorrhages have been described in other organs, such as the liver, supra renals, gastric mucosa, diaphragm, endocardium, and meninges. Hæmaturia has been often observed (Oldfield, Zabate), also epistaxis, hæmatemesis and cutaneous ecchymoses.

Pre eclamptic toxæmia is often associated with premature separation of the placenta, and especially with utero placental apoplexy. There may be eclamptic convulsions with the characteristic changes in liver and kidney. It is noteworthy that eclamptic changes have been found in these organs even when convulsions have never occurred. This condition was first described by Paul Bar in 1906, and was called by him "eclampsism." Since then other similar cases have been described by Portes, Brouha, Kellogg and Goethals.

Bilateral cortical necrosis of the kidney is sometimes associated with concealed accidental hæmorrhage. Its ætiology, and the relationship between it and concealed hæmorrhage, are discussed elsewhere (p. 327).

Placental Infarction Multiple white and red infarcts of the placenta are commonly associated with accidental hæmorrhage, especially of the concealed variety, but their significance is disputed.¹

Ætiology. The following are the chief causes that have from time to time been brought forward to account for the occurrence of accidental hæmorrhage.

Injury Since the time of Mauriceau at least, premature separation of the normally implanted placenta has been attributed

¹ The most likely explanation is that they are due to a toxin which destroys the syncytium lining the intervillous spaces. As the syncytium acts like a vascular endothelium in that it prevents coagulation of the blood its destruction leads to clotting. Villi embedded in the clot die because they no longer receive nourishment, as they normally do from the blood in the maternal sinuses, which has clotted around them and the clot and embedded villi form the red infarct—a firm solid area often half an inch or more in diameter. As the blood pigment is absorbed the infarct becomes hard and white. The hæmorrhages in the wall of the uterus and elsewhere may be accounted for by the action of the same toxin destroying the endothelium in the capillary walls just as it destroyed the endothelium of the maternal sinuses in the placenta (the syncytium) or it may be that they are due to the associated hypertension. Experimental evidence in support of the former view has been obtained by Claudia H. Dadds and the author.

to injuries such as a fall or blow on the abdomen strain from lifting a heavy weight jolts coitus or even emotional disturbance. Occasionally there is a quite definite history of such injury as in a case recorded by Edgar in which the woman pregnant eight months whilst hanging clothes from the fire escape of a tenement house leaned heavily with her abdomen against the iron railing faintness and hæmorrhage starting immediately or as in Pankow's case in which the bleeding began during coitus and was explained by the sudden turgescence of the uterus. In many cases however in which trauma is claimed as a cause the hæmorrhage has only begun some days later and in such there is probably no ætiological relationship. At the same time we have already seen (p. 140) that in the performance of external cephalic version in breech presentations partial detachment of the placenta resulting in antepartum hæmorrhage is one of the recognised dangers. There is no doubt that injury apart from that sustained in the performance of this operation is a very rare cause of accidental hæmorrhage.

Torsion of the Uterus In 1917 Morse sought to prove experimentally that torsion of the uterus was a frequent cause. He showed that by ligaturing all three groups of veins going off from one horn of the rabbit's pregnant uterus placental separation was produced with a hæmorrhagic infiltration of the uterine wall similar to that in utero placental apoplexy but that only a temporary cyanosis occurred if two of the outgoing veins were tied. There is however no other evidence that torsion plays any important part. On all the many occasions on which the abdomen has been opened in concealed hæmorrhage either before or after death only in one had the uterus undergone any marked degree of torsion such as would be likely to cause separation of the placenta. This was the case of Glinski in which a woman nine months pregnant was suddenly seized with abdominal pain and vomiting without any apparent cause and died three hours later. At the post mortem examination the uterus and appendages were found to have undergone axial torsion through three fourths of a circle (270°). The wall of the uterus was infiltrated with blood and the lower part of the placenta and the adjacent membranes were separated from it by a large clot. The fœtus was dead. No urinary examination seems to have been made but microscopically the liver and kidneys were normal.

Thrombosis of Veins Young states that he found thrombosis

of the left ovarian vein in one case, and believes that this explains both the placental separation and the hæmorrhagic infiltration of the uterine wall and appendages. The experiment of Morse, however, proved conclusively that the hæmorrhage never occurs unless *all* the veins draining one horn of the pregnant rabbit's uterus are tied. Besides other observers have failed to confirm the occurrence of ovarian thrombosis or of thrombosis of other main veins.

Endometritis This has been often claimed as the cause (von Weiss Seitz, etc.) The claim was based on the presence of leucocytic infiltration of the placenta and uterine wall. This however, is by no means constant and when present it is probably due to infection after placental separation has occurred some times at least from an intra uterine pack inserted to control bleeding. No one to day seriously believes that endometritis plays any part.

Traction on the Umbilical Cord The separation of the placenta has been often attributed to traction on a short cord. The best known case is that pictured and described by Pinard and Varnier in their Atlas of Obstetrics, but traction on the cord was only blamed in absence of any other ascertained cause and as the patient was not even in labour it is difficult to see how a short cord could so pull on the placenta as to separate it. It would be more conceivable during descent of the fœtus in labour but the theory would fail to explain the large majority of cases in which the separation of the placenta takes place before labour begins.

Toxæmia of Pregnancy There can no longer be any doubt that the chief ætiological factor is to be found in pre eclamptic toxæmia. Since Chantreuil, in 1881, and Fehling in 1885 observed that nephritis and accidental hæmorrhage were liable to be found together, the association has been noted by every writer. Garisani found albuminuria in 80 per cent and eclampsia in 6 per cent. Portes found toxæmia in 93.8 per cent and eclampsia in 8.3 per cent. In twenty three cases of accidental hæmorrhage from 1927 to 1932 in University College Hospital there was evidence of toxæmia in 83 per cent. In one of these there was bilateral cortical necrosis of the kidneys.

What is the relation between the toxæmia and the placental separation? The almost universal belief is that the toxæmia is the cause of the placental separation. Young, however, holds that the placental separation gives rise to the toxæmia by the

absorption of poisonous autolytic products from the partly separated placenta. But this hypothesis offers no explanation of the placental separation except thrombosis in an ovarian vein—an explanation that we have already dismissed as inadequate. The following considerations go to show that the toxæmia is the cause of the placental separation rather than its result.

(1) Cases are commonly observed in which accidental hæmorrhage supervened suddenly in patients already under supervision for pre-eclamptic toxæmia. Kellogg has seen eight such cases, Goethals eleven, Whitridge Williams three and the author five.

(2) Cases have been observed in which the patient had hypertension only without albuminuria or other signs of kidney involvement prior to the onset of hæmorrhage. The following case reported by Whitridge Williams is peculiarly instructive. The patient had essential hypertension in the medical clinic before pregnancy. When she became pregnant she was observed in the obstetric clinic for several weeks for the same reason, the blood pressure varying from 266 to 200 systolic and from 150 to 110 diastolic. There was no albumin in the urine at any time. When labour began the foetal heart sounds were audible, the blood pressure was 240 systolic, 140 diastolic, no albumin. Some hours later she began to bleed and the foetal heart sounds disappeared. Hysterectomy was done at once and 500 c.c. of old blood clot were found behind the placenta. The patient died five minutes later but no post mortem examination was obtained.

(3) Many observers have noted that patients with chronic nephritis are peculiarly liable to have accidental hæmorrhage (Polak, FitzGibbon, Browne). Indeed FitzGibbon reports a case in which a patient with chronic nephritis had accidental hæmorrhage in three successive pregnancies. Browne and Dodds produced chronic nephritis in animals before pregnancy by injecting sodium oxalate and found that in these ante partum hæmorrhage occurred spontaneously in the second half of pregnancy. In one it occurred in two and in another in four successive pregnancies. Besides it is well known that in chronic nephritis of the more severe degrees pregnancy usually ends in death of the foetus in the earlier months. In such cases the placenta is found to be extremely infarcted. Now there is reason to believe that some at least of the varieties of placental infarcts are comparable in the mode of their production to accidental hæmorrhage. If this is so it is strong evidence in favour of the view that accidental

hæmorrhage is not the cause but the result of pre-eclamptic toxæmia

Young claims that he has found support for his view in the finding by Miller and himself of albuminuria in a large percentage of patients with placenta prævia after the occurrence of bleeding. But Gladys H. Dodds, in University College Hospital has found albumin sometimes in large amounts, in the urine of 90 per cent of patients in labour, and as many of Young and Miller's patients were in labour, this evidence has no weight whatsoever.

(4) Attempts have been made to produce albuminuria, and the changes in the liver and kidneys characteristic of pre-eclamptic toxæmia by artificial separation of a portion of placenta in animals but always without success. See also Glinski's case (p. 246).

How does Toxæmia cause Accidental Hæmorrhage? Various explanations suggest themselves, of which we shall discuss only three.

(a) *Degeneration of the Vessel Wall* This explanation was offered by Whitridge Williams in 1915 when he described degenerative changes in the walls, especially in the intima of the smaller arterioles of the uterus. He believed that they were due to a circulating toxin resembling snake poison, which weakened the wall and thus caused the hæmorrhage. By 1925 he had abandoned this view as he had failed to find the changes in six further cases examined.

(b) *Areas of Focal Necrosis in the Muscle of the Uterus and in the Walls of the Vessels* In 1920 Gordon Ley reported the finding of such areas, and believed that they were due to a circulating toxin which also caused the hæmorrhage and œdema. He stated that the necrosis of muscle was not the result of the hæmorrhage, as it did not occur in areas in which hæmorrhage was present. Other observers (including Williams himself in 1925) have failed to confirm this, and the theory is now only of historical interest.

(c) *Hypertension* This explanation was advanced in 1912 by Wallich to account for the placental thrombi (infarcts) so common in pre-eclamptic toxæmia and eclampsia. He believed that the hypertension mechanically injured the syncytium covering the villi so that a coagulating substance was produced therefrom, and that the visceral hæmorrhages of eclampsia—in brain, liver, kidney, etc.—were due to the strain on the walls of the smaller vessels. The retroplacental hæmatoma and the hæmorrhages in

the wall of the uterus and elsewhere in accidental hæmorrhage may be produced in the same way. This view appears to receive support from the following considerations —

(1) Bleeding may occur in essential hypertension when there is no recognisable evidence of kidney disease nor of pre-eclamptic toxæmia. The case of Whitridge Williams recorded above (p. 248) is instructive in this connection.

(2) Bleeding often starts for the first time during delivery when there is a physiological rise of blood pressure.

(3) We shall see (p. 251) that the primigravida and the multipara are equally liable to accidental hæmorrhage. The former is more liable to pre-eclamptic toxæmia with hypertension, the latter to chronic nephritis and essential hypertension. The only factor common to both is the hypertension.

(4) We have seen that eclampsia occurs in about 5 per cent of patients with accidental hæmorrhage. Probably the percentage would be higher if hæmorrhage and shock did not cause the blood pressure to fall to a safe level. The effect is in fact much the same as would be obtained by venesection but greater because of the added shock.

How does Hypertension lead to Premature Separation of the Placenta? We may accept the view that the added strain on the thin walls of the engorged capillaries in the uterine wall and of the deciduas may itself be sufficient to lead to their rupture. But it seems more likely that the arteriolar spasm present in hypertension leads to anoxæmia and undernutrition in the capillary walls distal to the contracted area so that they readily give way when the spasm temporarily relaxes and the capillaries become again suddenly engorged with blood. This explanation is similar to that advanced by Westphal and Bar to account for the occurrence of cerebral hæmorrhage in hypertensive conditions.

Other Causes of Accidental Hæmorrhage. There are some well-observed cases in which there has been no evidence of pre-eclamptic toxæmia or hypertension at any time before the onset of hæmorrhage. Such was a patient at University College Hospital who had attended regularly at the antenatal clinic the last time a week before admission with severe concealed accidental hæmorrhage. There was no reason to believe that hypertension had developed in the week preceding admission for throughout her pregnancy no abnormality had been noted though she appeared to be undernourished. The cause in these is at present

unknown, but it is suggested that it is some dietetic deficiency—possibly vitamin C. Javert suggests that the hæmorrhages including retro placental hæmatomata, are of fœtal origin and reports a case in which they were associated with vitamin K deficiency in the infant. The mother's prothrombin concentration was normal but that of the infant was 18 per cent of the level in the normal adult.

The present position regarding ætiology may therefore be briefly summarised as follows —

(1) Trauma, especially by a blow on the abdomen, may sometimes cause accidental hæmorrhage, but such cases are rare. Attempts at external cephalic version are responsible for a few cases.

(2) Torsion of the uterus is a very rare cause, but at least one authentic case is reported.

(3) There is no evidence that traction on the cord, endometritis, inflammation of the decidua, or uterine wall or degenerative changes in the muscle or larger vessels of the uterus play any part.

(4) Pre-eclamptic toxæmia or even eclampsia is frequently associated with accidental hæmorrhage, and an ætiological connection between them must be assumed.

(5) There is much reason to believe that hypertension is the factor in the pre-eclamptic toxæmia that is responsible for the hæmorrhage.

(6) Essential hypertension may, in absence of pre-eclamptic toxæmia, cause accidental hæmorrhage.

(7) Chronic nephritis predisposes to accidental hæmorrhage. It probably does so by virtue of the hypertension accompanying it.

(8) Some cases may be due to dietetic deficiency—possibly vitamin C, E or K.

Clinical Features. About one case in four occurs in a primigravida. As the relative frequency of primigravida and multipara in the general population is 1 to 4 the liability of the primigravida and the multipara to accidental hæmorrhage is about equal.

In the concealed variety the symptoms are characteristic. The patient, usually in the last weeks of pregnancy, is suddenly seized with faintness and severe abdominal pain, with or without vomiting. The pain is variously described as "intolerable anguish," "as if about to burst," "the greatest torture," "a distressing feeling of tightness," "very violent cramping pain." Shock is usually very severe, and out of all proportion to

the amount of blood lost. The face is pale, and the pulse weak and rapid. There may be signs of pre-eclamptic toxæmia, such as œdema, albuminuria and hypertension, though if shock is severe, the blood pressure may have fallen to a normal or subnormal level.

The abdomen is hard, tense, tender and of wooden consistence, and is often larger than it should be for the period of pregnancy. This undue size is caused by the retroplacental hæmatoma. The case of Chevalier is often quoted in which a post mortem Cæsarean section on a patient whose uterus was the size of a full time pregnancy revealed only a three months' foetus, the great size of the uterus being due to retroplacental clot.

The foetal heart sounds are usually inaudible, as the foetus is killed if more than one third of the placenta is separated. It is nearly always impossible to palpate the foetal parts, partly because of intervening retroplacental clot, but chiefly from spasm of the abdominal muscles.

Sometimes there is a localised bulging corresponding to the retroplacental clot. Labour pains are usually absent—at least, while the shock lasts.

Vaginal bleeding, or the loss of bloodstained serum sets in in most cases sooner or later, that is, as soon as the uterine muscle regains its tone and begins to contract. It may, however, be entirely absent throughout but this is very rare. When the shock passes off, labour pains begin, but contractions are apt to be weak. After delivery the placenta is nearly always rapidly expelled with a quantity of old blood clot, some of which adheres firmly to the depressed area of the placenta.

In entirely external accidental hæmorrhage, the only sign is bleeding from the vagina. There may be antecedent pre-eclamptic toxæmia, chronic nephritis, or hypertension. Shock is absent except such as may be accounted for by the blood loss. As none of the blood is retained in the uterus the abdomen shows none of the characteristic signs found in concealed hæmorrhage. The foetal parts can be palpated and unless the placental separation has been very extensive, the foetal heart sounds may be still audible.

Diagnosis. In the concealed form there is usually no difficulty in diagnosis. The history of preceding toxæmia, chronic nephritis or hypertension, the pallor, shock, and restlessness, the tense, tender and woody abdomen, the impalpability of the foetal parts,

and the absence of foetal heart sounds, with or without vaginal bleeding are almost pathognomonic. We occasionally see cases, however, in which the abdomen is less hard than usual and in which the foetal parts especially the head at the pelvic brim are palpable. If the head is engaged or engaging in the pelvis it favours accidental hæmorrhage rather than placenta prævia. Concealed hæmorrhage, too, is extremely rare in placenta prævia, so this can almost be excluded on that ground alone. Diagnosis from rupture of the uterus may cause difficulty if the bleeding sets in during labour, as sometimes happens. The history is, however, quite different. Obstructed labour usually precedes rupture of the uterus but shock collapse and external bleeding may occur in both. In one case in University College Hospital concealed hæmorrhage was closely simulated by a volvulus of the cæcum and ascending colon, which was only revealed on opening the abdomen. The external variety must be differentiated from the unavoidable hæmorrhage of placenta prævia. This can only be done with anything approaching certainty with the patient under general anæsthesia and the whole hand in the vagina, the forefinger being then introduced through the internal os and passed up as far as possible in an endeavour to reach the upper border of the lower segment at every part of its circumference. If the placenta is not in the lower segment, the hæmorrhage is accidental. The value of X rays in diagnosis is discussed elsewhere (p. 543).

Prognosis. In the great majority of cases the bleeding is revealed, comparatively slight in amount, and with rest and treatment of the underlying toxæmia or hypertension may not recur, pregnancy then proceeding to term and ending normally. The prognosis is best in the revealed form there being no shock except that explained by the loss of blood which may or may not be large. In the entirely concealed type which is rare the prognosis is worst the uterine muscle being much injured and severe shock resulting which may be fatal. The loss of tone in the uterus causes inertia which predisposes the patient to post partum hæmorrhage should she survive delivery. In 22 cases collected by Barnes, the hæmorrhage was entirely concealed in 17, 13 died and 4 recovered. In Goodell's collected series of 106 cases of the concealed and mixed types only, 51 mothers died (51 per cent) and only 6 children survived. In all types taken together, including those in which the hæmorrhage is only revealed, the maternal

Watch pulse and blood pressure and size of uterus

When recovered from shock pitocin 2 units every half hour till good pains begin Care should be taken that the lie of the foetus is longitudinal before pitocin is given otherwise the contractions induced may rupture the uterus As the abdomen is hard and the foetus impalpable this generally entails a vaginal examination This should not however be carried out till the patient has recovered from shock and an anæsthetic should not be administered

Abdominal binder

If bleeding still continues and labour pains are absent Cæsarean section with or without hysterectomy If hysterectomy is considered unsafe on account of the patient's condition the uterus may be sewn up over a gauze pack

If bleeding continues and uterus is contracting and os definitely dilating rupture membranes and apply binder

Blood transfusion if necessary after hæmorrhage controlled whether by Cæsarean section or otherwise

No pack should be used in concealed hæmorrhage as it increases shock and may cause infection and thus prejudice chances if Cæsarean section has to be carried out Also it is ineffective as uterus is atonic

- (2) *If patient in Labour and Os dilating* Rupture membranes apply binder Pitocin may be injected if necessary

In all cases treat toxæmia if this is present Carefully guard against post partum hæmorrhage

The value of blood transfusion in all severe cases is to be kept in mind

Very little comment is necessary on this outline of treatment As in placenta prævia treatment in the patient's home is usually inadvisable and even a vaginal examination there is to be discouraged As pointed out previously (p. 223) it is useless unless it can be carried out under a general anæsthetic and with the whole hand in the vagina

External Hæmorrhage only In cases of external hæmorrhage it will be necessary to diagnose from placenta prævia (p. 19)

It will be observed that Cæsarean section is to be preferred to the vaginal pack if the patient is not in labour and the bleeding

is severe. The pack is probably entirely ineffective and is dangerous as it may cause sepsis. There is no evidence that it controls bleeding by compressing the uterine arteries as Tweedy claimed.

If the patient is in labour the treatment is nearly always simple and rupture of the membranes with the addition of an abdominal binder is all that is necessary.

Concealed Hæmorrhage or Concealed and Re-ealed In this case shock is usually very severe and must be controlled before any active treatment is undertaken. During shock the uterus is unable to contract and therefore the administration of ecbolics is useless. *The use of the vaginal pack in concealed hæmorrhage cannot be condemned too strongly.* If it is properly inserted it always adds to the shock already present. It causes sepsis and thus contra indicates Cæsarean section even though as sometimes happens the latter is necessary to save the patient's life. Finally, as the uterus is atonic the pack is useless either to control hæmorrhage or to induce contractions.

Cæsarean section has a definite though limited place in treatment. Hysterectomy is seldom necessary even in the concealed variety. But if when the uterus has been emptied by Cæsarean section it does not contract sufficiently after injection of pitocin (pituitary extract should never be used) into its muscle and the application of hot cloths and it appears to be dangerous to leave it hysterectomy may be performed but it is rarely necessary. As an alternative to hysterectomy which is a serious procedure in an already badly shocked patient the uterus after emptying it by Cæsarean section might be sewn up over a gauze pack the end of which is packed down through the cervix into the vagina so that it can be withdrawn easily twenty four hours later.

In the third stage the placenta is usually rapidly born and is followed if there has been concealed hæmorrhage by a quantity of stale blood clot and old fluid blood. Post partum hæmorrhage is liable to occur as the uterus has been over distended and its muscle has been damaged by the hæmorrhagic extravasation. It should never be forgotten that a slight post partum bleeding that in a normal parturient would have been of little account, may be fatal to a patient who has lost severely before delivery. Great care should therefore be taken to guard against post partum hæmorrhage, and preparations including in serious cases those for blood transfusion should always be made to deal with it.

Prophylaxis The possibility of the prevention of accidental hæmorrhage should not be lost sight of, especially in view of the evidence that hypertension plays a predominant part in its causation. The importance of the early diagnosis and treatment of pre eclamptic toxæmia, and especially of its accompanying hypertension, cannot be over-emphasised. The possibility, too, that dietetic deficiencies play a part in the causation of some cases should be borne in mind (p. 260), but regarding this we know at present little or nothing.

REFERENCES

- BAR, P., and DE KERVILLY, M. *Bull Soc d'obst de Paris*, 1906 IX, 118
 BARNES, R. "The Physiology and Treatment of Placenta Prævia." London 1838
 BROUHA. *Gynéc et Obstét*, 1920, 2, 373
 BROWNE, F. J., and DODDS, G. H. *Jour Obst and Gyn Brit Emp* 1929 35, 661
 CHANTRELIL, G. "Leçons faites à l'hôpital des cliniques," 1881
 CHÉVALIER, A. "Des Hémorrhages Utérines Pendant la Grossesse Pendant et Après l'accouchement." Paris, 1825, No 160, V, 194
 COUVPLAIRE, A. *Annales de gynéc*, 1912, 9, 486
 LIDGAR, J. C. "The Practice of Obstetrics" 4th ed. London Henry Irowde, 1917
 ICHLING, H. *Archiv f Gynäk*, 1885-6, 27, 300
 LITZGIBBON, G. *Proc Roy Soc Med*, 1926-7, 19 (Part 3) 80
 GAIFANI, P. *Lancet*, 1928, 1, 81 (Abst.)
 GLINSKI, L. H. *Monats f Geb u Gynäk*, 1910, 31, 431
 GOETHALS, T. R. *Am Jour Obst and Gyn*, 1928, 15 627
 GOODFILL, W. *Amer Jour Obst* 1869, II, 281
 JAVLRT, CARL T. *Amer Jour Obst & Gyn*, 1940, 40 453
 KFFLOGG, I. S. *Am Jour Obst and Gyn* 1928 15 337
 LFK, GORDON. *Proc Roy Soc Med London*, 1920, 14, No 2 155
 MORSE, A. H. *S G O*, 1918, 26 133
 OLDFIELD, C., and HAN, R. G. *Proc Roy Soc Med London* 1916-17 10, Part 2 (Sect Obst and Gyn) 17
 POLAK, J. O. *Am Jour Obst and Gyn*, 1931, 21, 218
 PORTES, L. *Gynec et obstet*, 1923 7, 56
 RIGBY, EDWARD. "An Essay on the Uterine Hæmorrhage." London, 4th ed., 1789
 TWEDDY, H. "Practical Obstetrics (Tweedy and Wrench) 4th Ed., 1919
 VON WELLES, O. *Archiv f Gyn*, 1894 46 256
 WALLICH, V. *Ann de Gyn et d'Obst* Par 25 IX., 496
 WESTPHAL, H. and BAR R. *Deutsche Archiv f Klin Med*, 1926, 151, 1
 WILLIAMS, J. WHITBRIDGE. *S G O*, 1915, 21, 561
 WILLIAMS, J. WHITBRIDGE. *Jour Obst and Gyn Brit Imp*, 1925, 32, 259
 YOUNG, JAMES. *Proc Roy Soc Med London*, 1914, 7, 307
 YOUNG, JAMES, and MILLER, D. A. *Proc Roy Soc Med Lond*, 1921, 14 (Sect Obst and Gyn) 247

CHAPTER XVIII

CONTRACTED PELVIS AND DISPROPORTION

THE various types of pelvis met with in the female may, following the work of Caldwell and Moloy, be classified as follows —

(1) *The Normal Female Pelvis (Gynecoid Pelvis)* (Fig. 39) The characters of this form are well known—the roomy, rounded inlet the wide subpubic angle with everted descending pubic ram the wide sacro-sciatic notch, and the shallow yet roomy cavity. The pelvic brim index (true conjugate $\times 100$ /greatest transverse diameter at brim) is over 90. Antero posterior positions of the vertex are the rule.

(2) *The Generally Contracted Pelvis* This pelvis is normal in shape but small in size. It is found in women of small stature and build but who are otherwise well formed. The baby is usually small so that there is often no trouble in labour. The pelvis is however funnel shaped and the outlet contracted in about 20 per cent of the cases and this may lead to arrest on the pelvic floor.

(3) *The Male Type (Android Pelvis)* (Figs. 41 and 42) This pelvis is very common but many of the women suffer from menstrual abnormalities and are sterile. The sacro sciatic notch is long and narrow and the sacro spinous ligament short. The subpubic angle is narrow the descending ram of the pubes passing directly downwards at an acute angle to each other and there is no eversion of their free edges. The pubo iliac portions of the ilio pectineal lines pass backwards from the symphysis at a relatively acute angle to each other thus lessening the spaciousness of the fore pelvis. The symphysis is deep (7 cm. or more) and the true pelvis as measured on a perpendicular line from the tuberosities of the ischium to the ilio pectineal line along the posterior border of the obturator foramen is increased in depth. This increase in depth and the consequent greater length of the descending pubic ram may occasionally make the ischial tuberosities far apart. The sacral promontory projects far forward producing a kidney shaped brim in which the widest transverse diameter is nearer than it should be to the sacral promontory, and the posterior segment of the pelvic inlet (the part behind the widest transverse



FIG 9 Radiographs of the average female pelvis (A) Inlet view (B) Anterior view (C) Lateral view (Caldwell and Moloy)



FIG 10 Radiographs of the average male pelvis (A) Inlet view (B) Anterior view (C) Lateral view (Caldwell and Moloy)

diameter) is small. The sacrum is wider and straighter¹ than in the normal female pelvis and finally, the four walls converge toward the outlet so that increasing difficulty may be met with as the head descends. Caldwell and Moloy believe the android pelvis to be one of the commonest abnormal forms met with and it occurred in over 30 per cent of the skeletal material examined by them. No doubt many of the pelvises diagnosed as 'flat' are really of this type. The head tends to engage in the posterior or transverse position and mid pelvic arrest is apt to occur if the transverse diameter of the outlet between the ischial spines is short.

(4) *The Von rickety Flat Pelvis (Platypelloid Pelvis)* (Fig. 41)

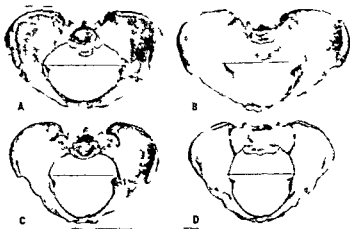


FIG. 41. Classification of pelvises with respect to the inlet. (A) The platypelloid type. (B) Android type. (C) Cynecoid type. (D) Anthropoid type. (Caldwell and Moloy)

The antero-posterior diameters of the inlet and cavity are shortened and the transverse increased. The pelvic brim index (see p. 258) is under 90 per cent. The head engages in the transverse diameter of the inlet. Caldwell and Moloy believe this pelvis to be rare and it occurred in only about 2 per cent of their cases. As noted above it is probable that the android pelvis has been often mistaken for it.

(5) *The Anthropoid Pelvis* (Figs. 41 and 42). This pelvis bears a close resemblance to that of the anthropoid apes. The sacrum is long, narrow and erect, has often six segments and is placed far

¹ Ince and Young, however, from examination of 50 male pelvises found that the sacrum is much more highly curved in the male than in the female.

back in the pelvis. The sacro-sciatic notch is wide and shallow. The antero-posterior diameter of the inlet is lengthened, and the transverse shortened. The subpubic angle is narrow, and the anterior part of the inlet is triangular in shape, because the iliopectineal lines flare backwards acutely from the symphysis. The head can only engage in the antero-posterior diameter, and if the head passes the inlet in the posterior position difficulty will often be experienced in rotation, because of the short transverse diameter. Delivery may best be accomplished by forceps in these cases with the head in the posterior position (face to pubes).

In all the above types the form is determined only by sexual,

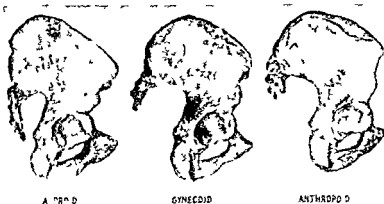


FIG. 42. Classification of pelvis from the lateral aspects. (A) The android type. Note the extreme male type of sacro-sciatic notch. (B) The gynecoid type. The sacro-sciatic notch is wide. (C) The anthropoid type. Note the extreme width and shallowness of the sacro-sciatic notch. (Caldwell and Moloy.)

racial and hereditary influences. In the two following classes the abnormality is due to pathological processes.

(6) *The Rickety Pelvis*. Various deformities may occur up to the pseudo-osteomalacic. In many the deformity is so extreme that the only possible treatment is Caesarean section. From the obstetric point of view the most important is the *rickety flat pelvis* in which the sacrum is rotated through a transverse axis passing through the middle of the sacro-iliac joints so that its promontory is thrown forwards and its lower end backwards. The antero-posterior diameter of the inlet is therefore shortened and that of the outlet increased. The innominate bones are flared outwards, so that the difference between the interspinous and intercrural diameters is often less than four fifths of an inch (2 cm).

(7) *Asymmetrical Pelves* In this group are placed various rare pelvic deformities due to such causes as hip joint disease congenital dislocation etc. There is generally spinal curvature and the pelvis is tilted to the diseased side and the lateral margin of the brim on the sound side pushed inwards and straightened. Attention is drawn to the condition by the obvious lameness and deformity.

Contraction of the Pelvic Outlet (p. 264)

Diagnosis of Pelvic Contraction In cases of extreme pelvic contraction there is usually no difficulty, for there are always other obvious deformities and often the stature is very short. In the more moderate cases there are seldom such obvious danger signals and attention should be paid to the following points.

(1) *The Obstetrical History* This may give most important information for example, the nature and result of the previous labours and the weight of the child. If a woman has given birth easily and spontaneously to an 8 lb child that is alive and well and if the weight of the child can be verified contracted pelvis can generally be excluded. There are however occasional exceptions to this rule. MacLennan in a study of the cases of contracted pelvis in Glasgow found that spontaneous delivery of a live infant weighing 8 lb 4 oz occurred in one case of severe pelvic contraction (true conjugate $3\frac{1}{2}$ inches or less) while in two cases of moderate contraction (true conjugate over $3\frac{1}{2}$ inches and less than $3\frac{3}{4}$ inches) a live 8 lb child was born spontaneously.

(2) *The Appearance of the Woman including Stature* The first ante natal examination should always include measurement of the patient's height. She may be well formed but shorter than normal when generally contracted pelvis should be suspected or the short stature may be due to rickets of which other signs may or may not be present in the skeleton.

It is important to remember that there may be a slight or even moderate degree of pelvic contraction though the patient shows no other clinical evidence of rickets. It is usually said that the presence of male secondary sex characters such as a male distribution of hair on abdomen thighs etc. should lead one to suspect an android pelvis but Ince and Young failed to find any conclusive evidence of connection between them. Caldwell and Moloy stress the importance of the *perineal slope* in diagnosis of the type of pelvis. When the woman is in the lithotomy position the slope will be found to vary from a perpendicular to the horizontal to the other

extreme in which the inclination forms an acute angle with the floor, the average slope being somewhere between these extremes. An acute inclination is most often seen in the android forms, the tuberosities of the ischium projecting considerably in advance of the symphysis, and thereby producing a marked perineal slope. Important information may also be gained by palpation of the subpubic angle. In the male type of pelvis the descending rami of the pubes are straight and grip the examining finger.

(3) *Non engagement of the head* in a primigravida three weeks before the expected date of delivery is always a suspicious circumstance. There are other causes (p. 86) but contracted pelvis is one of the commonest and must always be excluded.

(4) *Malpresentations*, especially shoulder presentations, and particularly in a primigravida should always arouse suspicion. A transverse lie in a multipara is often due to a lax abdominal wall.

(5) *Pendulous Belly*. This, especially in a primigravida should always lead one to suspect contracted pelvis. The abdomen is pendulous because the foetus lies entirely above the pelvic brim. In a multipara it may be due to lax abdominal walls.

(6) *Pelvic Measurements*. These should never be neglected for they are of great assistance in, for example, diagnosis of the generally contracted and of the simple flat and rickety pelvis. In the generally contracted pelvis the measurements are smaller than normal, but they are diminished in proportion to each other. For example, the interspinous diameter may be $8\frac{1}{2}$ inches (21.5 cm), the intercrystal $9\frac{1}{2}$ inches (24.1 cm), and the external conjugate 7 inches (17.7 cm). In the rickety flat pelvis the difference between the interspinous and intercrystal diameter is usually less than $\frac{1}{2}$ inch (2 cm) though it may be quite normal. In both the generally contracted and the flat pelvis the external conjugate is usually less than $7\frac{1}{2}$ inches (19 cm), and the diagonal conjugate is less than 5 inches (12.7 cm). The method of taking pelvic measurements is described on p. 87. Of all the measurements the most important is the diagonal conjugate, and, in measuring it, care must be taken that the finger reaches the promontory and is not on the body of the sacrum below it.

(7) At the same time as the diagonal conjugate is being measured, other points, the importance of which in diagnosis of pelvic type and capacity has been emphasised by Caldwell and Moloy, may be noted. The 'angle of the fore pelvis' between the superior rami of the pubes may be accurately estimated by turning

the examining fingers anteriorly on either side of the urethra " In the majority of cases the anterior portion of the inlet can be palpated for a considerable distance posteriorly, and experience will permit the examiner accurately to judge the width of the fore pelvis. The same information may be gained on external examination by grasping the lower abdomen between the fingers and thumb at the level of the upper border of the symphysis. The superior pubic ramus may be thus felt passing straight backwards and outwards from the symphysis and at an acute angle to each other. The capacity of the posterior pelvis can be approximately estimated on rectal or vaginal examination by palpation of the sacro-sciatic notch and estimating the length of the sacro-spinous ligament. 'The examining finger locates the ischial spine and follows the most prominent part of the ligament to its insertion along the lower lateral border of the sacrum' (Caldwell and Moloy). A short ligament, two fingers breadth or less in length, suggests a male pelvis provided the sacrum is not abnormally curved forward in its lower part. Finally, the anterior surface of the sacrum may be palpated to find whether it is concave as it should be or straight or even convex.

Contraction of the Pelvic Outlet It is well known that outlet contraction of varying degree occurs in several varieties of contracted pelvis. Examples are the *justo minor* (generally contracted) pelvis in which funnelling or exaggerated contraction of the outlet as compared with the inlet occurs in about 20 per cent of cases the obliquely contracted the kyphotic the spondylo-lithetic and the osteomalacic pelvis and in some cases of severe rickets. With the exception of the first the deformity is generally obvious and they are so rare as to be of little practical importance.

Funnel Pelvis in normal Women What is less well known is that outlet contraction due to funnelling sufficient to cause dystocia, may occur in pelvises that show no other abnormality and in patients who show no evidence of rickets. According to Thoms this is the most common variety of contracted pelvis in white women, and was present in 5 per cent of the cases examined by him and Whitridge Williams. We have already seen that this funnelling is a constant characteristic of the male pelvis and that it is often present in the android pelvis in which there may be no other clinical abnormality. Its importance lies largely in the fact that it is liable to be overlooked until late in labour when it causes delay in the midpelvis.

or at the outlet necessitating delivery by forceps, which may be easy or exceedingly difficult according to the degree of disproportion present. It is responsible for many of the cases of deep transverse arrest of the head in posterior positions of the occiput, while Caldwell and Moloy state that it may cause delay in dilatation of the cervix (prolongation of the first stage). Chassar Moir, too, considers that it may be a cause of contraction ring dystocia. As the pubic arch is narrowed its anterior part may be unable to accommodate the head, which is then, during its exit from the birth canal, forced backwards towards the sacrum with the result that deep perineal lacerations are very frequent.

Though most of the observations on the funnel pelvis have been made in American clinics, the work of Hastings Ince and Matthew Young in University College Hospital, London shows that it is of frequent occurrence in England. In 393 women whose pelvis were examined by them the transverse diameter of the outlet was from 10 to 35 per cent smaller than the transverse of the inlet. Of all the pelvic sex characters examined by them the only two which had any appreciable influence in determining whether spontaneous delivery would occur or not were the size of the outlet and the width of the subpubic angle. As dystocia through contracted outlet, however, chiefly occurred in primiparae it is probable that the difficulties are increased by rigidity and perhaps thickness of the soft parts.

It is generally agreed that if the transverse diameter (the greatest distance between the inner lips of the tuberosities of the ischium) measures 8 cm. or less the outlet should be regarded as dangerously contracted. Antero-posterior contraction (of the diameter between the lower border of the symphysis and the tip of the sacrum) may also occur though it is less common than transverse narrowing. They may, however, be associated and this adds materially to the seriousness of the prognosis. As the pubic arch is narrowed and its anterior part may therefore not be available for passage of the head the prognosis for spontaneous delivery largely depends on the posterior sagittal diameter (the distance between the transverse of the outlet and the tip of the sacrum). Thoms states that, in general, if the sum of the transverse and posterior sagittal diameters does not amount to 15 cm. or over spontaneous delivery of the full time child is unlikely.

The methods of measuring the outlet both by palpation and by X rays are described on p. 40.

As to treatment it is only necessary to say here that by putting the patient in the exaggerated lithotomy position or in the Sims position with the lower extremities more sharply flexed than usual it is possible according to Thoms to increase the antero-posterior diameter of the outlet by as much as 1 cm.

Examination by X-rays See p. 41, and Chapter XXX.

Manual Method of roughly assessing Amount of Disproportion

Some idea of the amount of disproportion between head and pelvis can be formed by the following manoeuvre (Fig. 43)



FIG. 43. Method of estimating disproportion by external examination. The foetal head is grasped in the left hand and the head is pushed downwards and backwards into the pelvis in the axis of the inlet. The amount of overlap if any is estimated by the fingers of the other hand placed on the front of the symphysis. (Chassar Moir)

Grasp the head with the left hand and push it downwards and backwards (in the axis of the inlet) into the pelvis. At the same time place the fingers of the other hand (the forefinger will suffice) on the upper border of the symphysis in order to estimate the amount of overlap if any. It may be found (a) that the head can be made to enter the pelvis so that there is no overlap and no disproportion. (b) that the head overlaps slightly so that the parietal bone is flush with the anterior surface of the symphysis. The overlap here is about $\frac{1}{4}$ inch (1 cm) viz. the thickness of the symphysis pubis. This may be called *disproportion of the first degree*. The disproportion is so slight that the head will mould through the brim if given time to do so. (c) That the head overlaps so much that the parietal bone over

hangs the anterior surface of the symphysis. This is disproportion of the second degree or the *overhanging head*. The disproportion in this case is too great to allow passage of the head no matter how much it moulds and the only treatment is Cæsarean section at term. At best this is a crude method of assessing disproportion much more so than the bimanual method to be described later (p. 278) and should never be relied on for it gives but the roughest indication of the relative sizes of head and pelvis.

It sometimes helps to push the head into the pelvis if the patient is made to *sit up on the couch and bend forwards* as much as possible remaining so for a few minutes. Thus the long axis of the uterus is shortened and a head that is freely movable may, if there is no disproportion, enter the brim.

Management of Patients with Contracted Pelvis There are three methods at our disposal: (a) Cæsarean section at term; (b) trial labour; and (c) induction of premature labour.

Treatment of Contracted Pelvis by Cæsarean Section This is indicated if the true conjugate is under $3\frac{1}{2}$ inches (8.9 cm). The operation should be carried out at term.

In an elderly primigravida it is usually the best method of treatment in all cases unless, as may happen in contracted pelvis of very slight degree, there is no disproportion and the head is engaged at or just before term.

Treatment of Contracted Pelvis by Trial Labour This is suitable for young primigravidae with a true conjugate of $3\frac{1}{2}$ inches (8.9 cm) or over and a vertex presentation. The patient is allowed to go into labour spontaneously at term and the progress is carefully watched. If after a fair test of labour the head does not enter the pelvic cavity (its widest diameter through the brim) a lower segment Cæsarean section is performed.

Before deciding that the case is suitable for a trial of labour the true conjugate should be measured by means of X-rays for the ordinary clinical methods of estimation are not sufficiently accurate. By X-rays too may be ascertained the exact type of pelvis with which we have to do.

Assessment of Disproportion in Trial of Labour If we depend on pelvic measurements alone in deciding whether a patient shall be given a trial of labour we are obviously assuming that the child is of average size. If the child is much above the average size and especially if it is post mature with a well-ossified head it

may fail to pass though the degree of contraction is slight or even if the pelvis is normal. X-ray cephalometry will of course give the necessary information, but in its absence it is useful to assess the relative sizes of head and pelvis by the bimanual method (p. 278) carried out at term or early in labour. If it is found that the head *can be made to descend to the pelvic floor* we may rest assured that there will be no difficulty on account of pelvic contraction provided the outlet is satisfactory. If on the other hand there is present a first degree overlap (p. 279) there is a very good chance that with a well managed trial of labour the head will mould through. And if finally, the second degree of disproportion is present (p. 279) the head is unlikely to pass and Cæsarean section is usually advisable. By means of the internal fingers some idea can be gained too of the plasticity of the foetal skull. The one factor in a trial labour that we are unable to foresee is the strength of the uterine contractions, and unfortunately weak pains may upset *all our calculations and render artificial termination either by forceps or Cæsarean section necessary* in a case in which all the other factors are favourable.

Method of conducting a Trial Labour. The patient must be in hospital or similar institution under constant observation by a skilled person, and facilities must be at hand for Cæsarean section, should that become necessary. The method is quite unsuited for domiciliary practice.

Labour is generally allowed to come on spontaneously at term. There is no objection, however, to trying to start labour a week or so before term by giving a modified drug induction (Appendix D) *without pituitary extract, which is unsafe if there is disproportion*. This may or may not be successful, if it fails no harm is done. It may be repeated at term, for it is inadvisable that the child of a patient who is to have a trial labour should be allowed to become post mature. Without the use of pituitary extract, however, we are severely handicapped in so far as induction by drugs is concerned and instrumental methods are, of course, out of the question.

The progress of the labour is carefully watched by a trustworthy person. The following points should be attended to —

(1) *The foetal heart sounds* should be counted at intervals, varying with the stage of labour and the frequency of the pains, and according to whether the membranes are ruptured or not. Discretion must be used in this matter. It is usually inadvisable to

wake a patient who is having a much needed sleep between pains, in order to count the foetal heart rate and it should be remembered that the danger to the foetus varies with the length of time the membranes have been ruptured and the strength and frequency of the pains, and that it is not in danger as long as the membranes are intact

(2) *The behaviour of the foetal head* is to be noted—whether it engages in the pelvic brim and if so, whether it descends into the pelvis and how much This is done entirely by abdominal palpation

(3) *Vaginal examinations* should be avoided or reduced to an absolute minimum As a rule not more than one is necessary and even that may be dispensed with and most of the information it gives can be obtained by rectal examination At the same time we do not believe that if a vaginal examination is felt to be necessary it very materially adds to the risk of subsequent Cæsarean section provided it is carried out as it always should be with strict surgical cleanliness as described for induction of labour (p 278) The vaginal examination should usually be delayed until at least an hour, or better still two hours after rupture of the membranes the patient in the meantime having had good pains every five minutes or thereabouts

What information may a vaginal examination afford? In the first place the extent of dilatation of the cervix should be noted and whether the cervix is closely applied to the head If it is the prognosis is favourable But if, on the other hand the cervix is not taken up and hangs long and loose, with possibly an œdematous anterior lip vaginal delivery is unlikely and it is usually best to have recourse to Cæsarean section Secondly the extent to which the head has descended into the pelvis should be observed The ischial spines are useful landmarks as they indicate the level of the pelvic floor Thirdly, it may, if the descent of the head is unsatisfactory, be noted whether there is a parietal presentation, and if so of what variety In posterior parietal presentation in which the sagittal suture approaches the symphysis, the outlook for delivery by the natural passages is unfavourable In anterior parietal presentation with the sagittal suture approaching the sacrum, the outlook is favourable This applies of course, only to the flat pelvis Finally, an attempt may be made to push the head into the pelvis in the manner described later (p 278) No anæsthetic is necessary or advisable for this examination for it

may be needed later for Cæsarean section or delivery by forceps and two in such quick succession are undesirable

(4) *Premature rupture of the membranes* is a special risk in trial labours as the head is high and fits the brim imperfectly, and measures must therefore be taken to preserve them intact, for the earlier they rupture the more the foetus is endangered, and the greater the risk to the mother if Cæsarean section has to be carried out. There is also the risk of prolapse of the cord which is always apt to occur when the presenting part is high and fits badly into the pelvic inlet. During the first stage, therefore, the patient should be kept in bed and an enema should be avoided after labour begins. With this in view the bowels should have been kept freely opened for several days before.

(5) *Importance of Sleep and Nourishment* In trial labour primary uterine inertia is apt to be present, probably because the high head is unable to exert pressure on the cervix, and thus set up strong contractions. The first stage of labour is therefore liable to be very prolonged on account of weak, infrequent pains, and sometimes lasts for two or three days or more. Provided the membranes are intact there is little cause for anxiety. The foetus is not in danger, and though the mother is apt to get tired and discouraged from loss of sleep, her general condition does not deteriorate. If the membranes rupture prematurely, however, the case is entirely different. The life of the foetus is endangered because as the liquor amni drains away the uterus tends to contract and retract on the foetus and placenta, and there is a risk of foetal asphyxia. There is also a risk of congenital pneumonia from aspiration of infected liquor amni (Browne). For the mother the chief danger is infection of the amniotic cavity and its contents. If this occurs the infecting organisms are liable as Warnekros has shown to traverse the placenta and spread into the maternal blood setting up a bacteræmia with accompanying pyrexia. The chances of infection increase in proportion to the length of time the membranes have been ruptured and if it occurs not only does the mother's condition deteriorate, but if Cæsarean section has to be performed the prognosis is seriously prejudiced.

In primary uterine inertia it is important to procure sleep. For this we have found that 2 grains of opium pill are useful and it may be repeated each night. It has the great advantage that it does not tend as morphia does, to cause foetal apnoea. An alternative

is a sedative mixture containing potassium bromide and chloral hydrate, of each 25 grains, tincture of opium 10 minims, and chloroform water to 1 ounce. This may be repeated every four or six hours. If an analgesic is required in the later stages of labour one of the best will be found to be nembutal and chloral. Nembutal, 3 grains, is given in capsule followed in twenty minutes by syrup of chloral, 2 drachms. Four or six hours later the dose is repeated, but only $1\frac{1}{2}$ grains of nembutal are given. This may be repeated again after the same interval but usually not more than 6 grains of nembutal should be given altogether and never more than $7\frac{1}{2}$ grains. No less important than sleep is suitable nourishment. Fluids should be given frequently. The best is glucose in water or lemonade—one heaped tablespoonful to 1 pint and this may be given *ad lib*. Other fluids that may be given are hot milk tea, hovril ovaltine, etc. If the patient is vomiting the fluids given to her a small quantity of solid food is sometimes effective in stopping it and giving her nourishment—biscuits dry toast, jelly, or a small piece of steamed fish rabbit or chicken.

The Duration of a Trial Labour If after a fair trial of labour the head fails to enter the pelvic cavity a lower segment Cæsarean section should be performed. *A fair trial of labour can only be said to have been given when good pains have been recurring every four or five minutes for at least two hours, during which the cervix has been fully dilated and the membranes ruptured.*

But while this is a good working rule it may in some instances be undesirable to wait so long. For example the cervix may be unduly rigid, and in consequence full dilatation may be long delayed and in the meantime the mother may show signs of distress, or if there is primary uterine inertia with premature rupture of membranes there may be, as pointed out above evidence of commencing intra amniotic infection or pyrexia or again, before full dilatation the foetal heart sounds may be found to be getting unduly slow, or meconium may be escaping in the liquor amni—usually a danger signal if the vertex is presenting. This is particularly likely to happen if the membranes have been long ruptured, and though a fair trial of labour cannot yet be said to have been given, Cæsarean section may be considered necessary for the sake of the child. Such an undesirable state of matters should however, have been anticipated, especially as in not a few cases the foetal heart suddenly stops without any previous undue rapidity or slowing. There is, therefore, in the conduct

of a trial labour abundant opportunity for the exercise of judgment in selecting the proper time for interference

Caldwell and Moley state that when the head is held close to the sacral promontory a longer trial of labour is justifiable, because it is situated over the posterior pelvis in an ideal position for descent

Peckham and Kuder after noting the high foetal mortality when trial labour had lasted more than thirty hours with adequate pains question the wisdom of allowing a trial labour to progress more than twenty four hours providing uterine contractions are adequate unless all signs point to speedy and spontaneous delivery Lower segment Cæsarean section then becomes the procedure of choice for the child although entailing probably some added risk for the mother

Chassar Moir emphasises the value of an X ray picture—a lateral view—in all cases where progress is not satisfactory The position and attitude of the head and its relation to the pelvis can be seen—a valuable aid in coming to a relatively early decision as to whether labour should be allowed to proceed or be terminated by lower segment Cæsarean section

Termination of a Trial Labour by Forceps When the head has descended into the pelvic cavity, and provided the cervix is fully dilated, the labour may if necessary, be terminated by forceps *They should not however be used unless there is a definite indication namely maternal or foetal distress The determination whether the cervix is fully dilated should be made by examining not during a pain only but also between pains* This is an important precaution for if examined during a pain the cervix may seem to be fully dilated and it may be decided to apply forceps When, however, the patient is put under the anæsthetic the pains pass off and the head recedes and the cervix may then be found to be only half dilated Yet the operator with all preparations made and the patient under the anæsthetic feels constrained to proceed few having sufficient moral courage in such circumstances to confess to an error of judgment and to desist until proper and safe conditions are established As is well known the results are often disastrous We believe that this is the cause of many of the premature applications of forceps through a partly dilated cervix

It should however be clearly understood that in a contracted pelvis delivery is only possible when considerable head moulding compensates for the pelvic contraction This necessitates a pro-

longation of the second stage of labour. Forceps are not called for because of the disproportion, but because of maternal or foetal distress. The indication for the use of forceps is maternal or foetal distress, and unless one of these indications is present they should not be used.

We have laid it down above (p. 272) that one of the conditions for the safe application of forceps is that the head should be in the cavity of the pelvis. We might even go further than that, and say that it is rarely advisable to apply forceps unless the lowest part of the head has reached to at least the level of the ischial spines—*i.e.*, the level of the pelvic floor. Application of the forceps to a head higher than this (the so-called 'mid forceps') is attended by a very high foetal mortality and even by a considerable maternal mortality. If the head is at a higher level lower segment Cæsarean section should be given careful consideration, provided the child is alive and in such a condition that it is likely to survive and second, that there is a reasonable probability that the mother is free from serious, especially streptococcal infection.

Contra-indications to Trial Labour. (1) As pointed out above trial labour should only be employed in cases of *moderate* disproportion. It is usually inadvisable if the true conjugate is under $3\frac{1}{2}$ inches (8.9 cm.) unless the child is small and there is obviously no serious disproportion as shown by cephalometry or by the bimanual methods of examination described on pp. 278-9.

(2) Trial labour is inadvisable in an elderly primigravida with disproportion, unless she deliberately chooses it, after the risks to the child have been explained to her. Cæsarean section is usually best. The same applies to an elderly multipara who has no living child.

(3) It is, of course, contra-indicated in breech cases. The essence of the trial labour is that the head is given time to mould but no moulding of the head can take place in a breech delivery. If, however, cephalic version can be done (p. 138), trial labour may be good treatment. The problem then becomes the same as in a vertex case.

(4) Induction of premature labour is usually preferable in a patient who has had a previous unsuccessful trial of labour, and even though the trial of labour resulted in the birth of a live child, provided the labour had been prolonged and difficult, whether terminated by forceps or not, induction of labour two or three weeks before term is usually advisable in succeeding preg-

nancies The induction is best carried out by bougies or puncture of hind waters (p 283) Artificial rupture of forewaters is contra indicated as the head is not engaged in the pelvis

Advantages, Disadvantages and Risks of Trial Labour The great advantage of trial labour is that it abolishes the need for instrumental induction of premature labour an operation that is often needlessly performed This will be discussed later (p 286) and will not be further considered here This advantage is so great that most obstetricians believe that it outweighs the disadvantages, the chief of which are as follows (a) The supervision of trial labour is often an anxious matter making large demands on the time of the medical attendant, and even more so on his skill and judgment (b) A trial labour can only be conducted in an institution in which lower segment Cæsarean section can be performed if necessary (c) The risks to the child are considerable Prolapse of the cord may occur, though it is rare excessive moulding of the head may lead to intra cranial injuries or asphyxia and the probability of these may be much increased if forceps extraction of the head becomes necessary, while premature rupture of the membranes followed by a long labour may cause intra uterine death of the foetus from undue compression of the placenta by the excessively retracted uterus It has been shown too that when the membranes have ruptured prematurely there is a not inconsiderable risk that the child may be born with catarrhal pneumonia from which it may succumb shortly after birth, or that it may even be born dead from this cause (Browne) (d) The mother may suffer a long exhausting labour that predisposes her to sepsis and post partum hæmorrhage, if the membranes rupture prematurely there is the added risk of intra amniotic and transplacental infection and bacteræmia (p 270) Primary uterine inertia often complicates a trial labour The reasons for it and the risks attendant upon it if the membranes have ruptured prematurely have been already considered (p 270) If labour pains are strong and frequent and interference is too long delayed secondary uterine inertia or rupture of the uterus may occur, and finally the case may end in Cæsarean section which is attended by a certain immediate and delayed maternal mortality Many consider this to be the most serious objection of all, as a Cæsarean section carried out in a young primipara seriously prejudices her ^{civil}le obstetric future One consideration however, should not be ^{comp}ght of namely that if Cæsarean section becomes necessary

after a trial of labour, in order to overcome insuperable obstruction it is carried out for a proved pathological condition, whereas many instrumental inductions are performed unnecessarily in patients who would, if left alone, have delivered themselves easily at term. If the result is unfortunate on account of sepsis or other accident to the mother, a physiological condition has been converted into one that is pathological.

Prognosis of Trial Labour That trial labour entails a considerable foetal mortality is obvious in view of the risks pointed out in the previous section. This is substantiated by the report of Peckham and Kuder on 422 cases in whom the trial labour had lasted more than thirty hours and in whom delivery took place by the natural passages. The gross foetal mortality was 19.23 per cent and the maternal 1.36 per cent. Almost half the labours to be terminated by some sort of operative procedure included craniotomy in twenty-four. The foetal mortality varied directly with the size of the child. Obviously the only way to reduce this high foetal mortality is to shorten the duration of the trial labour, and terminate it earlier and more frequently by lower segment Caesarean section.

Trial labour is also attended by considerable risk for the mother. We have already seen that in Peckham and Kuder's cases the immediate maternal mortality was 1.36 per cent even when delivery took place by the natural passages. There is in addition a considerable delayed mortality. One cause of this is the occurrence of adhesions after Caesarean section which occasionally result in intestinal obstruction, sometimes many years after the operation. Another cause is rupture of the uterine scar in a subsequent pregnancy or labour. This has been shown by Eardley Holland to occur in 4 per cent of all patients who undergo Caesarean section and who again become pregnant. Its cause is failure of muscular union, resulting in a thin weak fibrous scar which readily gives way when the uterus is being again distended by pregnancy, or during the contractions of labour, especially if the labour is prolonged or difficult. The main cause of the defective healing is sepsis during the puerperium, and Holland points out that even in an elective Caesarean section surgical cleanliness can never be guaranteed as the cavity of the uterus is in direct communication with the vagina, which is not a sterile tract and may sometimes even contain virulent organisms. The more stormy the convalescence after Caesarean section the greater the

possibility that the uterine scar will be inadequate though even when the puerperium has been apparently afebrile perfect healing cannot be guaranteed. For this there are two reasons (a) mild sepsis is not always accompanied by a rise of temperature (b) during the puerperium the uterus is rhythmically contracting and relaxing so that the wound of the classical operation is never at rest, and is often under considerable tension. In the lower segment operation which is nowadays universally employed after trial labour this factor is far less in evidence and it is therefore probable that an imperfectly healed scar is less common after it than after the classical operation. This may however be to some extent counterbalanced by the fact that during labour the lower segment becomes stretched and thinned.

From these considerations it will be evident that the performance of Cæsarean section after a trial of labour is always attended by the possibility that subsequent deliveries will have to be effected by the same method. Generally speaking it will be unwise to allow labour to take place by the natural passages if the convalescence after the previous section has been stormy. The risk attendant on natural delivery will be increased if the patient on whom the Cæsarean section has been performed was a *primigravida* for then the soft parts have never been dilated by the passage of a full time child and labour may therefore be expected to be more prolonged and difficult and to throw a greater strain upon the uterus.

The Abuse of Cæsarean Section in Contracted Pelvis It will be evident from what has been already said that the selection of cases for trial labour and the conduct of it together with the choice of the proper time for interference should the natural forces fail call for considerable judgment and experience. The patient should always be in an institution under the care of an experienced obstetrician who is able should necessity arise to interfere to the best advantage. With these limitations the trial labour is an excellent method of treating moderate degrees of pelvic contraction or disproportion in young *primigravidaë*. In the vast majority of such patients delivery takes place by the natural passages with excellent results for mother and child. Cæsarean section performed indiscriminately in such cases without any previous test of labour is perhaps the most abused operation in obstetrics. It should never be forgotten that Cæsarean section carried out even by experts in the best surroundings has a mortality of 1 to 2 per cent.

When it is recalled that the maternal mortality for England and Wales is 4 per 1 000 and that Cæsarean section has a mortality in the best circumstances of 10 to 20 per 1 000 it will be appreciated that its performance for any but the most definite indications is far from being in the best interests of the patient. Munro Kerr uses strong words on this. Writing regarding the trial labour and the abuse of classical Cæsarean section without giving the patient a chance to deliver herself, he says 'All this (the proper management of a trial labour)' takes time and many are unwilling to give the case the continued observation necessary, with the result that the 'classical operation' is performed in many cases unnecessarily. Further, the uterus is left weakened after the 'classical operation'. The merest tyro can remove the child by this means. It will be a sad day for obstetrics and for the community if Cæsarean section is freely and light heartedly employed in complications which can be successfully overcome by manipulations and devices long associated with the art of obstetrics.

With this quotation and emphasising the statement that most patients with moderate degrees of pelvic contraction as defined above deliver themselves if given a chance to do so we shall leave the subject of trial labour for the present. Later we shall give some comparative figures illustrative of the results of trial labour and induction of premature labour (p. 287).

Treatment of Contracted Pelvis by Induction of Premature Labour. This method may be used as an alternative to 'trial labour' when the conjugate is $3\frac{1}{2}$ inches (8.9 cm.) or over. It gives excellent results if precautions are taken to ensure (a) that the induction is not carried out before the end of the 36th week, and (b) that strict surgical cleanliness is maintained throughout the operation. Induction of premature labour for contracted pelvis is a peculiarly English method of treatment, and has never found much favour in American or Continental clinics.

The Management of a Case. The patient is examined at the end of the 36th week from the first day of the last menstrual period. An anæsthetic is not necessary, unless she is very stout. The bowels and bladder must be empty. The external genitals are shaved and washed with soap and water. Gloves and a mask should be worn. All the information to be got from clinical and X ray examination of the pelvis should have been already obtained (p. 202).

The examination is carried out in the lithotomy position. A catheter is passed, the external genitals and adjacent parts of the thighs are painted freely with equal parts of a 1 in 1 000 solution of acriflavine and brilliant green in methylated spirit or washed with 1 in 1 000 perchloride of mercury. A speculum is now passed and the vagina and cervix are mopped with a sterile solution of bicarbonate of soda to remove mucus. One of the above solutions preferably the first is now poured into the vagina and swabbed over its whole surface and over the vaginal part of the cervix. A sterile towel is placed over the abdomen and another under the buttocks. Next the diagonal conjugate is measured unless an accurate measurement has been already obtained by means of X rays. If the patient is under an anæsthetic a very accurate measurement can be taken even in the lithotomy position. If she is not under an anæsthetic it is an advantage to turn her on to the left semi prone position with both knees well drawn up for in that position the promontory can be more easily reached (p. 39).

Having measured the diagonal conjugate we proceed to the next step namely the estimation of the amount of disproportion if any between the head and the pelvis. This is done by Munro Kerr's modification of Muller's manœuvre. With the patient in the lithotomy position pass one or two fingers or the half hand into the vagina and locate the ischial spines. With the other hand usually the left grasp the head above the pubes the sterile towel intervening and push it gently but firmly downwards and backwards into the pelvis. It helps very materially if an assistant at the same time pushes the fundus downwards with the forearm or wrist. If difficulty is experienced in getting the head to enter, continuous pressure should be maintained for one or two minutes. This allows the head time to find the easiest diameter of engagement and settle into the pelvis. Whilst thus maintaining pressure with the external hand the degree of descent is noted by the internal fingers.

We may now find one of the following conditions —

(1) The head can be made to descend easily until its lowest parts are at the level of the ischial spines i.e. the floor of the pelvis. In such cases there is no disproportion and no need for interference. The patient should be examined again at such time as disproportion is expected to arise. This time varies with the difficulty that has been experienced in getting the head to enter. It may be a week.

or ten days, or it may be considered that she can be safely left even longer

(2) It may be impossible to make the head enter the pelvis or even "bite" and the anterior surface of the parietal bone is found to be flush with the anterior surface of the symphysis pubis. This relationship is most easily noted by the thumb of the internal hand placed vertically on the front of the symphysis pubis. In this case the head is overlapping by the thickness of the symphysis, and therefore about $\frac{1}{2}$ inch over its inner margin. This is the *first degree of disproportion*. In such cases labour should be induced at once, if possible, and certainly the operation should not be put off longer than two or three days. The head will mould through if time is given.

(3) Not only may it be impossible to make the head enter but it may be found that it distinctly overhangs the anterior surface of the symphysis, so that the thumb laid on the front of the symphysis impinges on the under surface of the parietal bone. This is *second degree disproportion* or "*the overhanging head*". The disproportion is so great that the head will not mould through however long it is given to do so. The proper treatment is Cæsarean section at term. Such a severe degree of disproportion is rare at this period (end of the 36th week) except when the pelvic contraction is very marked, and the true conjugate less than $3\frac{1}{2}$ inches (8.9 cm.)

Whilst carrying out this examination an attempt should be made to estimate the degree of ossification of the fetal skull, by noting the hardness of the bones, their mobility, and the width of the sutures. This can be done fairly satisfactorily through the vaginal fornices. We are thus able to form a good idea of the amount of moulding that may be expected to occur and, incidentally, to confirm our previous diagnosis of the stage of pregnancy reached. This is especially valuable in examinations near term.

This method of assessing disproportion calls for considerable experience such as can probably only be gained by practising it frequently in hospital or elsewhere. The beginner usually errs on the side of pessimism, thinking there is disproportion when there is none. In consequence a large majority of the inductions carried out are unnecessary. A useful check on the procedure here described is the measurement of the shortest diameter of the fetal head by the methods of cephalometry described on p. 516.

Cephalometry is also of value if there is any doubt about the duration of pregnancy or about the weight and consequent viability of the child.

Methods of inducing Labour Drugs are usually ineffective for induction of premature labour, and the more premature the labour is the less likely they are to be successful. Unless therefore, the patient is within a week or two of term it is usually useless to waste time with this method. In any case it is unwise to include pituitary extract in the induction course, for when there is disproportion its use is unsafe. The course should stop with the castor oil, hot bath and enema (Appendix D).

In most cases instrumental methods are resorted to at once and the following are those most commonly used.

Gum Elastic Bougie It is important not to use a bougie that is too hard and stiff as with it the placenta is apt to be separated. A satisfactory type is the Eynard bougie which is so resilient that it doubles up if it encounters the edge of the placenta. It is sterilised by boiling for 5 minutes or by immersion for twelve hours in a cold solution of perchloride of mercury (1 in 1 000). It is passed by sight with the help of a Sims or weighted speculum. The external genitals and vagina must be cleansed and disinfected if this has not been already done (p. 277) a catheter passed and sterile drapings put on. The cervix should be dilated with metal dilators until it admits the forefinger if it does not already do so. In carrying out this dilatation the anterior lip of the cervix should be grasped with a ring forceps not with a volsella, as it tears easily and bleeds readily. The forefinger is then passed gently inside the internal os and swept around the lower uterine segment so as to separate the membranes as high up as can be reached or a large thick metal dilator can be used instead. Care is taken not to rupture them. The speculum is again inserted the anterior lip of the cervix caught with the ring forceps and the bougie is passed into the uterus between the membranes and the uterine wall. As it can be most easily inserted along the posterior wall it is tried there first, being gently insinuated towards the fundus. If resistance is encountered it is unwise to try to overcome it, as the point has probably come up against the edge of the placenta. It should be withdrawn and inserted with the same care on the opposite side. A second or even a third bougie may be inserted if the soft Eynard bougie tends to double

up difficulty may be encountered in inserting more than two, and indeed more are not usually necessary. When the bougies are properly inserted not more than an inch protrudes from the cervix. The vagina is now loosely plugged with part of a sterile gauze roll, the first 2 or 3 inches of which are wrapped around the ends of the bougies. A sterile vulval pad is put on and the patient returned to bed. Labour usually starts in twenty four to forty-eight hours and is rarely delayed for seventy two hours. During this time the patient is kept in bed and the temperature taken twice daily. If there is no pyrexia the bougies should not be removed even after seventy two hours. If at the end of seventy two hours labour has not begun it is wise to remove the pack, leaving the bougies in and insert a fresh pack after a hot vaginal douche.

When labour begins the bougies should not be removed at once, but left until the os is well dilated and the membranes bulging. If they are removed too soon labour is liable to come to a stand still.

The Solid Rubber Bougie (Fig 44) The method of introduc

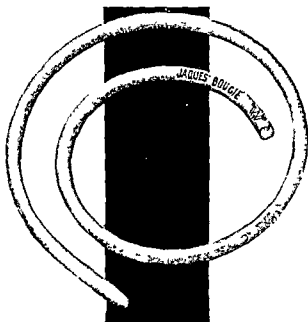


FIG. 44. Solid Rubber Bougie

tion is similar to that described above except that there is no need to separate the membranes with the finger before inserting it.

After the first 9 inches or so have been introduced difficulty is often encountered in pushing it any farther. To overcome this the bougie should be given a slight twist on itself after which it will be found to enter easily. The end of the bougie should lie inside the internal os. We now prefer this bougie to the gum elastic variety because (1) it can be boiled repeatedly (2) there is no risk of separating placenta as the bougie being soft



FIG. 43. Induction of labour. Solid rubber bougie *in situ* in the uterus.

and pliable coils on encountering the slightest resistance (Fig. 45) (3) labour comes on quicker as the membranes are separated by the coiling bougie over a wide area of the lower uterine segment (4) the bougie lies in the lower uterine segment only so that if any septic material is introduced with it there is less risk than if it were carried up to the fundus as it might be by the gum elastic bougie. Some authorities use a stomach tube instead but it has no advantages over the solid bougie and being softer is more difficult to introduce.

Hydrostatic Bag. In this method a small hydrostatic bag

holding about 8 ounces, is introduced empty inside the uterine cavity between the membranes and the uterine wall. The bag is sterilised by boiling and the quantity of fluid it holds measured. As in the introduction of gum elastic bougies, the membranes around the internal os should be separated by the finger as far up as possible. The bag is rolled up into the smallest possible bulk and grasped thus in a ring forceps, beyond the end of which the rolled bag should project about 2 inches. Thus it is pushed carefully through the internal os, care being taken not to rupture the membranes. The forceps are then removed, a Higginson's syringe attached to the nozzle of the bag and the measured quantity of fluid pumped slowly in. The tap is closed so as to shut the nozzle, the Higginson syringe removed, and a 1 lb weight attached (not necessary and not always done) to the end of the tube. Lowry, of Belfast, uses a toy balloon, which holds about 3 ounces. The balloon is introduced on the end of a catheter around which its neck is tied. It is usually claimed that hydrostatic bags induce labour more quickly than bougies, and that their use is therefore indicated when there is urgency. This, however, has not been our experience, and we have found that sometimes the bag is quickly expelled and that pains then cease making necessary reinsertion of the bag. There is no risk of separating the placenta, and, as the bag does not reach far inside the uterus, there should be less risk of sepsis.

In all the methods described above there is the disadvantage of the continuous presence of a foreign body inside the uterus for twenty four to seventy two hours or more with considerable risk of resultant sepsis. Largely because of this the method of induction by puncture of the hind waters introduced by Drew Smythe in 1931 is gaining in favour.

Puncture of the Hind Waters In this method which is only to be used in vertex presentations the membranes are punctured above the head and a variable quantity of liquor amni drawn off by a special instrument such as the Drew Smythe catheter and stilet (Fig 46). An anæsthetic is not usually necessary nor is it often necessary to dilate the cervix. With the patient in the lithotomy position the skin of the external genitals and of the area surrounding is disinfected and the vagina prepared (p 277). The index finger of the left hand is passed through the internal os till it comes in contact with the fetal head. The catheter is then passed, with the stilet withdrawn, along the posterior surface of the

interior of the uterus, between it and the membranes, till its point reaches the groove of the neck. The stilet is now pushed home and the membranes punctured. Withdrawal of the stilet allows

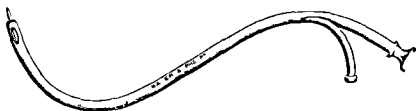


FIG. 46. The Drew Smythe Catheter

the liquor to flow out through the catheter. It is usually sufficient to withdraw from 10 to 16 oz. and when this has been done the catheter is removed. If labour has not started in forty-eight hours a medical induction should be given without pituitary extract (Appendix D p. 584).

As the membranes are punctured above the head there is no risk of prolapse of the cord and the opening in them not being over the internal os there is less risk of intra-amniotic infection.

Rupture of the Forewaters. We do not advise this method in cases of disproportion as the head is not engaged and prolapse of the cord may therefore occur. Besides it is undesirable that the poorly ossified head should be used as a dilator of the cervix. It is however a more rapid and certain method of induction than puncture of the hind waters and for that reason is often preferable in other types of case such as eclampsia. The operation carried out with full aseptic precautions and an anæsthetic is rarely necessary.

In order to get satisfactory results from induction in cases of contracted pelvis the following precautions must be taken —

(1) *The operation should not be performed before the end of the 36th week at earliest* and of course the longer it can be delayed after that time the better it is. Before the end of the 36th week the child's chance of survival is so small that induction is not worth while. The accurate estimation of the duration of the pregnancy may be an easy matter, but it may also present great difficulty, and all the resources at our command should be employed (p. 124). As previously stated the end of the 36th week is 202 days after the first day of the last menstrual period. The value of cephalometry in doubtful cases should be borne in mind (p. 546).

(2) *The Induction must be carried out with the most strict surgical precautions* Gloves and mask should be worn, and the operation area disinfected and surrounded by sterilised cloths. In bougie induction, the bougie should be introduced by sight, the operator drawing the cervix down so that a good view is obtained of it. As we can never be sure of having rendered the vagina sterile, whatever method of disinfection is used the point of the bougie should not be allowed to touch it but its first contact should be with the cervical canal in the neighbourhood of the internal os. At best, induction is a septic operation and it is our duty to minimise the dangers as much as possible.

Management of Labour after Induction Time should be given for the head to mould. As the skull is not well ossified it usually moulds much better than had been expected. *Forceps should if at all possible be withheld* as the skull and the cranial contents are very easily injured.

Contra-indications to Induction (1) In severe degrees of pelvic contraction (true conjugate below $3\frac{1}{2}$ inches (8.9 cm)) induction should not usually be performed. The proper treatment is generally Cæsarean section at term.

(2) In an elderly primigravida classical Cæsarean section at term is usually preferable to induction. The same applies to an elderly multipara who has no living child.

(3) If the breech is presenting, external version should be done before induction. Not only does this give a better chance to the child but only with the vertex presenting is it possible to assess the degree of disproportion between head and pelvis, and so estimate the proper time for induction.

Advantages and Disadvantages of the Induction Method There are several advantages in the induction method of treating contracted pelvis. The mother is saved a long and sometimes very exhausting "trial labour," and if induction is not done before the end of the 36th week the results so far as the child is concerned are quite good. R. W. Johnstone enquired into the after histories of 104 babies born after induction for contracted pelvis in the Edinburgh Royal Maternity Hospital during the five years from 1923 to 1927. Of these, 72 were traced in 1929. Four of them had died in the first year of life, leaving 68 alive at the end of the first year, i.e., 91.4 per cent. This compares favourably with 90.5, which is the percentage of all infants that one may expect to be alive at the end of the first year of life, according

to figures supplied by the Registrar General for Scotland. At the end of the second and third years the percentage alive was 87.5 and 84.7 respectively. Johnstone considers it reasonable to assume that the twenty-seven untraced cases would not be subject to a higher mortality and finds himself therefore "in disagreement with those who take a pessimistic view of the prospects for the infant."

The great disadvantage of the induction method, on the other hand, is that it leads to a great deal of unnecessary and dangerous interference. A large majority of the patients who are induced for supposed disproportion would deliver themselves easily if left alone. Wrigley, for example, by a study of the reports of five hospitals has shown that, judging from the presence or absence of moulding of the foetal head, in 50 per cent. of the cases in which labour was induced for "disproportion" the operation was unnecessary.

The chief reason why unnecessary inductions are done even in hospital practice is that it is often difficult or even impossible to assess accurately the degree of disproportion or, indeed, whether it is present at all or not. Munro Kerr's words in this connection are worth quoting. "It is always possible," he says, "at the 36th or 37th week to determine if the head *will pass* in slight degrees of pelvic deformity, and it is always possible to determine that it *will not pass* in extreme degrees of pelvic deformity. But in 'border line' cases (medium degrees of pelvic deformity) it is impossible at this stage of pregnancy to determine with certainty whether the head *may pass* at term or not as the attitude of the head and condition of the soft parts are very different at the 36th or 37th week and at term or early in labour. A decision can only be reached with certainty in 'border line' cases after labour has been in progress for some time and the head has assumed a definite position, and the soft parts are relaxed and thinned out."

Even if the degree of disproportion in these border line cases could be accurately assessed there are still two almost unknown factors which have a great influence on the course of labour, namely the plasticity of the foetal head and the extent to which it will mould, and secondly, the strength of the expulsive forces. These can only be tested by a trial of labour.

Now, provided they were not done before the end of the 35th week, these unnecessary inductions would not matter so very

much if they were always safe. But experience shows that they are by no means so, and that in a small percentage of cases death follows either directly or indirectly from such causes as sepsis, hæmorrhage (from separation of the placenta), or anæsthetic complications, and that in many more grave illness follows though the patient escapes with her life. Bourne states that of 156 cases of sepsis admitted to the isolation block of Queen Charlotte's Hospital twelve (7·6 per cent.) followed instrumental induction of labour. If the case has been misjudged in the other direction, and instrumental induction is done when there is insuperable disproportion the Cæsarean section that is sometimes carried out to overcome the difficulty becomes the most dangerous procedure in obstetric surgery.

It is often asserted that while 'trial labour' is a method for the specialist who has the surroundings of an institution and special skill at his disposal, the induction method is suitable for the general practitioner. When one considers the difficulties and dangers described above, and the aseptic and antiseptic technique that is essential to make the operation moderately safe it may well be doubted whether the one is better suited for domiciliary practice than the other. All cases of contracted pelvis or suspected disproportion should be treated in an institution where the best facilities and surroundings are at hand.

Induction of Labour often preferable in Multiparæ. If a multigravida with a moderate degree of contraction has had a previous trial of labour, and has just failed to accomplish her task successfully, the labour having to be terminated by lower segment Cæsarean section, or perhaps by a difficult forceps delivery, it is usually unwise and unnecessary to submit her to a trial of labour a second time, unless there is reason to believe that the child this time is much smaller, for we have already obtained information as to what the natural forces can accomplish. Rather should such a patient be induced at the 37th or 38th week, the exact time being estimated in the manner above described (p. 278).

Comparison of Results obtained from Induction of Premature Labour and Trial Labour in Treatment of Contracted Pelvis

Vivian Barnett has recently analysed the results obtained in University College Hospital from (a) instrumental induction of premature labour in the period from 1921 to 1931, and from (b) trial labour in the period 1932 to early in 1941. In both cases

only primiparæ were considered and those in which the pelvis was contracted to a slight or moderate degree, viz C V $3\frac{1}{4}$ to 4 inches inclusive

Results of Induction of Premature Labour There were 111 cases in the first period and induction was carried out by bougie or bag or by both methods, but the great majority by bougies. All were induced from the 36th to the 39th week. The foetal and neonatal mortality was 11.7 per cent and of the infants leaving hospital all were in good condition. There was one maternal death from septicæmia and 9 other cases reached the morbidity standard a total maternal morbidity rate of 9 per cent. In 88.3 per cent delivery was spontaneous with a foetal mortality of 11.2 per cent. The forceps rate was 11.7 per cent with a foetal mortality of 15.4 per cent. There were no Cæsarean sections or craniotomies.

Results obtained from Trial Labour There were 57 cases in which trial of labour was carried out from 1932 to 1941. The foetal and neonatal mortality was 12.8 per cent. There was one maternal death due to an incompatible blood transfusion given for post partum hæmorrhage and the total maternal morbidity rate was 12.3 per cent. Spontaneous delivery occurred in 22 cases (28.6 per cent) with a foetal mortality of 13.6 per cent, 11 (19.3 per cent) were delivered by forceps with a foetal mortality of 27.3 per cent. There were twenty three Cæsarean sections (40.3 per cent) and one craniotomy.

It will be observed that apart from the incidence of Cæsarean section the results from the two methods are very much alike though slightly in favour of induction. The frequency of Cæsarean section is however, very great in the trial labour group. This might mean that trial labour was adopted in too severe degrees of pelvic contraction. If it had been used in less severe degrees for example when the C V was $3\frac{1}{4}$ inches or over the number of terminal Cæsarean sections would have been no doubt diminished but the number of planned Cæsarean section would have been increased and the total number would have remained the same or been still greater. It is important to compare the Cæsarean section rate in all cases of contracted pelvis during the two periods. This was 29 (20.7 per cent) in the induction period (total number of cases of contracted pelvis treated 140) and 38 (50 per cent) in the trial labour period (total number of cases treated 76).

Conclusions After a comparison of the results obtained in treatment of cases of contracted pelvis during the induction

period (1921-31) and the trial labour period (1932-41) we find that the results are better from induction in that —

(1) The total Cæsarean section rate, planned and terminal for contracted pelvis in the induction period was only 20 per cent whereas in the trial labour period it was 50 per cent of all cases of contracted pelvis of whatever degree treated

(2) The foetal and neo natal mortality is somewhat lower in the induction group (11·7 per cent as compared with 15·7 per cent)

(3) The maternal morbidity is somewhat lower in the induction group (9 per cent as compared with 12·3 per cent)

The most serious indictment of trial labour therefore is the high Cæsarean section rate that it entails. It appears that the number of cases can only be diminished by prolonging the trial of labour with a *serious increase in foetal mortality*. As Barnett points out in his review, the number of unnecessary inductions (the chief indictment of the induction method) can be cut down by the routine employment of X ray pelvimetry in addition to clinical methods so that induction is only carried out when the pelvis is definitely contracted. Trial labour might still be employed when there is disproportion and a normal pelvis.

The Danger of Disproportion in Multiparæ with Normal Pelves. Because a woman has had several children without trouble it does not necessarily follow that her coming labour will be normal and easy. The danger in the old multipara has been recently emphasised by Leyland Robinson, who, from an analysis of hospital reports, concludes that while in parous women labours become progressively safer up to the fourth, after that time there is liable to be difficulty that tends to increase with each pregnancy. He puts this down mainly to calcium depletion, so that the muscular system in general, including the muscle of the uterus, loses its tone. This leads to inertia and dystocia.

There seems, too, to be a tendency for the child to be larger and to be carried longer in each successive pregnancy. Green-Armytage states that in the Eden Hospital, Calcutta, 27 out of 104 craniotomies in a period of ten years were carried out on mothers between the ages of thirty and forty, all of whom had previously had many normal labours. In some of these the child was unduly large, in others there was an impacted posterior position, in a few the pelvic rami had become beaked, and in almost all there was a history of primary and then of secondary inertia, associated with flabby atonic muscles which were unable to

complete the labour. He considers that calcium depletion leads to a flabby condition of the uterus and of the muscles generally, and possibly also to some degree of osteomalacia. While osteomalacia of such severe degree as to cause pelvic deformity does not occur in Great Britain, there is no doubt that difficult labour is not infrequently encountered in women who have had previously easy labours, and who have no pelvic contraction.

REFERENCES

- BARNETT VIVIAN (in the Press)
 BROWNE F J *Brit Med Jour*, 1922, 11, 590
 CALDWELL W E and MOLOY, H C *Proc Roy Soc of Med*, 1938 9 32,
 No 1 1
 CALDWELL W E, and MOLOY, H C *Am Jour Obst and Gyn*, 1933 26, 479
 CALDWELL W E MOLOY, H C, and DESORO, D A *Am Jour Obst and Gyn* 1936 32, 727
 CALDWELL W E MOLOY, H C, and DESORO D A *Am Jour Obst and Gyn* 1935 30, 763
 DREW SMYTHE, H J *Brit Med Jour* 1931, 1, 1018
 DREW SMYTHE, H J, and THOMPSON, D JOAN *Jour Obst and Gyn Brit Emp* 1937, 44, 480
 GREEN ARMYTAGE, V B *Ind Med Gaz*, 1928, 63 357
 GREEN ARMYTAGE V B *Clinical Jour*, 1931, 60, 318
 HOLLAND EARDLEY *Jour Obst and Gyn Brit Emp* 1921, 28 488
 LACE J G HASTINGS, and YOUNG MATTHEW *Jour Obst and Gyn Brit Emp*, 1940 47, 130
 JOHNSTONE, R W *Jour Obst and Gyn Brit Emp*, 1929 36 390
 KERR, J M MUNRO 'Maternal Mortality and Morbidity, a Study of their Problems' Lavingstone, Edinburgh 1933
 MOIR CHASSAR *Edinburgh Med Jour*, 1941, 48, 361
 MOIR CHASSAR *Brit Med Jour* 1941, 11, 821
 PECKHAM, C H, and KILDER, K *Amer. Jour Obst and Gyn*, 1934 27, 573
 ROBINSON, A LEYLAND *Brit Med Jour*, 1930 11, 47
 THOMAS HERBERT 'The Obstetric Pelvis' The Williams & Wilkins Coy., Baltimore 1935

CHAPTER XIX

DISPLACEMENTS OF THE UTERUS IN PREGNANCY

Retroversion

RETROVERSION of the gravid uterus is practically always due to the occurrence of pregnancy in a uterus already retroverted. Occasionally it may arise from backward displacement of an already pregnant uterus owing to a fall, or some violent straining effort if the bladder is over-distended. The pressure of the abdominal wall is exerted on the distended bladder and through it on the uterus, pushing it backwards.

Clinical Features Before the 12th week the condition gives rise to no symptoms. In most of these cases the uterus rights itself spontaneously, before it causes any trouble, and the pregnancy continues normally.

After the 12th week, if the uterus has not righted itself, symptoms usually begin to appear. The growing uterus has now become "incarcerated" or imprisoned, and is large enough to exert pressure on the pelvic organs, and so pain in the back may begin, and a bearing down feeling in the pelvis, but the most striking symptom is difficulty in passing urine. This difficulty increases till about the 16th week, when complete retention occurs, with "overflow incontinence" and dribbling of urine. The retention may, however, come on quite suddenly and without any premonitory symptoms and on account of the misleading incontinence the real nature of the case may be overlooked. The bladder becomes enormously distended so that it commonly reaches the umbilicus or above it and the distension causes severe and distressing abdominal pain. If the condition is not relieved the resulting cystitis and kidney infection may cause high temperature, rapid pulse, delirium, coma and death from uræmia. The urine is alkaline, has an ammoniacal odour, and contains pus, albumin, micro organisms and flakes of mucous membrane. Such an advanced and serious state of affairs is however rare, if ever, seen nowadays, though examples are not infrequently found recorded in the literature of fifty years ago.

Causes of the Retention These are two (1) The cervix is displaced upwards so that it lies close behind, or even above the symphysis, and thus presses on the neck of the bladder. (2) The

upward displacement of the cervix stretches and elongates the anterior vaginal wall, and thus elongates and narrows the urethra within it

Pathological Considerations The bladder may become enormously distended, commonly containing 5 or 6 pints of urine. Its walls become œdematous and thickened. The retained urine gets infected and causes cystitis which is sometimes very severe. Hæmorrhages may occur underneath the mucosa and in the muscular wall, and may result in the exfoliation of large flakes of mucous membrane and even muscle. Cases have been recorded in which the entire mucous membrane was shed and passed by the urethra, and others in which the muscular and peritoneal coat became necrotic and was shed, a new receptacle for the urine being formed in the cases that survived by the matting together of surrounding tissues. Rupture of the bladder, followed usually by death from peritonitis, may occur as a result of necrosis, or may follow attempts at replacement. Ascending infection may cause pyelitis, pyonephrosis and uræmia. There may be constipation from pressure by the uterus on the rectum, and occasionally the accumulation of fecal masses above the fundus may constitute an additional obstacle to replacement.

Terminations (1) One possible termination has already been referred to, namely, *incarceration*, and, if not relieved, death from septic infection and uræmia, or from peritonitis consequent on rupture of the bladder, or recovery may take place, a fresh receptacle for the urine being formed by the matting together of the pelvic organs. Fortunately, more favourable terminations are the rule, namely —

(2) *Spontaneous Rectification* This is the most usual ending, as the uterus enlarges it rights itself, being probably dragged upwards by the growing anterior wall.

(3) *Abortion* This is the next most common ending, and arises from the interference with the natural growth of the uterus.

(4) *Sacculation* This is very rare. The anterior wall, expanding, forms a large pouch projecting upwards into the general abdominal cavity. Even in such cases natural delivery will usually occur at term, but labour is apt to be premature.

Diagnosis After incarceration the main points are (1) Signs of early pregnancy (2) Bearing-down feeling in the pelvis or severe pain in the lower abdomen (3) History of retention or incontinence (4) Distended bladder, forming a cystic elastic

swelling, reaching to the umbilicus or above (5) Because of the distended bladder the abdomen is much larger than it should be for the period of pregnancy (6) The fundus of the uterus is absent from its normal position and is felt in the pouch of Douglas (7) *The cervix is high up behind or above the pubes* It may point upwards and forwards and often is almost out of reach If the uterus is retroflexed, rather than retroverted, this sign is less evident The cervix may then point downwards and forwards, though it is much farther forward than normal (8) After the bladder is emptied no abdominal tumour is felt, as there should be if the pregnancy has reached the 16th week

Differential Diagnosis *Ruptured Tubal Gestation and Pelvic Hæmatocele* This is discussed on p 180 If there is any doubt about the character of the abdominal swelling a catheter should be passed

Salpingitis There are no signs of early pregnancy, but there is fever, rapid pulse, etc The uterus is, on bimanual examination, felt in its normal position, and there is nothing characteristic about the position and direction of the cervix.

Fibroid tumour in the posterior wall of the pregnant uterus may simulate a retroverted gravid uterus very closely Careful examination will, however, reveal the fundus in its normal position and that the cervix is not, as in retroverted gravid uterus high up behind the symphysis pubis

Ovarian Tumour in the Pouch of Douglas either Combined with Pregnancy or not The fundus of the uterus is here in its normal position, and the position and direction of the cervix are quite different from that in retroverted gravid uterus though it may be pushed, with the entire uterus, somewhat forwards or be displaced to one side. There is usually no retention of urine

In any case, if there is a distended bladder when the patient is first seen, or a supra pubic swelling that might possibly be such, a catheter should always be passed before further attempts at a diagnosis are made

Treatment (1) *If the Retroversion is discovered in the Early Weeks of Pregnancy, and before Incarceration* The uterus should be replaced manually (see below) and a Hodge pessary inserted and left in till the 5th month The replacement in such early cases does not usually present any difficulty, but if attempts fail a ring pessary should be inserted as advised by Sinclair

(2) *After Incarceration* After symptoms have set in treatment

is more difficult. The patient is put to bed morphia, gr $\frac{1}{2}$, given hypodermically and the catheter passed every six hours, the bowels should be opened if necessary by enemas. She should lie on her face as much as possible, and assume the knee-chest position for ten minutes every hour throughout the day. During the night she should be instructed to lie on her side rather than on her back. In 90 per cent of cases after such measures the uterus rights itself largely because the weight of the distended bladder that was keeping it down has been removed. For emptying the bladder a soft rubber catheter should be used but if on account of the narrow urethra this cannot be passed a gum elastic catheter should be used instead.

Occasionally there may be difficulty in withdrawing the urine because blood clot or necrotic portions of bladder wall block the eye of the catheter. It may then be necessary widely to dilate the urethra or even to open the bladder from the vagina in order to evacuate its contents. If there is cystitis, acid sodium phosphate gr xxx, and hexamine gr x should be given three times daily and the bladder irrigated once or twice daily with a solution of boric acid crystals. This treatment may be necessary for a long time after the uterus has been replaced.

Manual Reposition. If spontaneous reposition has not taken place after two or three days, manual reposition should be tried. This should be attempted without an anæsthetic first of all, and with the patient in the dorsal or Sims position. The manoeuvre differs in no respect from that employed in replacing the non-pregnant uterus except that it is advisable to try to push the fundus up past the *right side of the sacral promontory*. If this fails the attempt may be repeated with the patient in the knee-chest position and it is sometimes an advantage to try with the finger in the rectum.

If these attempts do not succeed, what is to be done? It is usually advised to wait a few days, keeping the bladder and bowels empty meanwhile, in the hope that spontaneous reposition will occur and if it does not do so, to try replacement under an anæsthetic. A far better plan however, is that advised by W J Sinclair namely, to insert a ring pessary. Next day the uterus will often (in our experience always) be found to have become replaced. Sinclair advises that after emptying the bladder the rubber ring pessary should be inserted without any previous attempt at replacement. We have used the method in five cases,

and in all it succeeded admirably. A large size should be chosen—as large as the patient can comfortably bear so that when in position its shape is elliptical rather than circular. In order to minimise the risk of abortion it is well to administer morphia after the pessary has been inserted.

An alternative to the pessary is to place a hydrostatic bag in the vagina and distend it with water. Munro Kerr advises placing the metreurynter in the vagina and to distend it while the patient is in the lithotomy position and then allow the legs to fall down as in the Walcher position.

If the pessary and the hydrostatic bag fail it is usually best to attempt replacement under anæsthesia. Should this fail recourse should be had to laparotomy.

The alternative to this is to empty the uterus from below but on account of the abnormal position of the cervix great difficulty may be encountered in carrying out this procedure.

Prolapse

Some degree of descent of the vaginal walls and even of the uterus, is not incompatible with pregnancy and is not infrequently met with. As a rule it is only troublesome in the first four or five months as after that time the large uterus is supported by the pelvic brim and the symptoms are relieved. As, however, the uterus is held up by the bony ring of the pelvic inlet rather than by the structures that should normally support it, the pressure is liable to cause premature birth.



FIG. 47 Shelf pessary
(PAU & Barra & Co
Birmingham)

Treatment. In the early months the patient should be fitted with a large vulcanite or rubber ring which should be changed every month and may usually be dispensed with after the end of the 5th month. If on account of a very deficient perineum the pessary cannot be retained a cup and stem pessary may be tried or the shelf pessary of Sir J. A. Simpson (Fig. 47).

Pregnancy in a completely prolapsed uterus is rare but may occasionally be met with. In such cases it is usually necessary to keep the patient in bed more or less throughout the whole pregnancy. The cervix may not dilate well in labour because of the fibrosis and thickening often present and it may be necessary to

divide it after it has been thinned out by the advancing head. This may be done by cutting it in one or two places usually postero laterally by blunt pointed scissors. Keettel among 140 cases of severe prolapse in pregnancy collected or studied by him found that 93 per cent required incision of the cervix to effect delivery. The foetal mortality was 22 per cent and the maternal mortality 63 per cent chiefly from puerperal sepsis. About six months after delivery the prolapse should be repaired.

Pendulous Abdomen

This condition in which the uterus is much anteverted and hangs forward over the pubes when the patient stands up is often met with in the subjects of contracted pelvis or in multiparæ with very lax abdominal walls or wide separation of the recti muscles. A well fitting abdominal belt or home made binder preferably with an elastic inset should be worn which enables the patient to get about with a certain degree of comfort.

In extreme cases in which the abdomen overhangs the pubes there may be more or less severe intertrigo affecting the skin of the lower part of the abdomen and even of the upper part of the thighs. As the skin of the affected area is then almost certain to harbour micro-organisms the condition must be cured before Cæsarean section which may be necessary for contracted pelvis can be undertaken with safety. It will be understood too that a pendulous abdomen apart altogether from the pelvic contraction that often causes it is a severe handicap to the normal progress of labour as the uterine forces not being directed in the axis of the pelvic inlet act at a mechanical disadvantage. Besides as the recti are often widely separated the secondary forces are apt to be less efficient than usual. To counteract these disadvantages it is advisable that during labour the patient should lie as much as possible in the dorsal position and wear a tight abdominal binder.

REFERENCES

- KEETTEL W. C. *Am Jour Obst and Gyn* 1941 42 121
 KERR J. M. MUNRO *Operative Obstetrics* Baillière Tindall & Cox
 4th ed. 1937 3 8
 SINCLAIR W. J. *Lond Obst Soc Trans* 1900 42 338

CHAPTER XX

VOMITING IN PREGNANCY

ABOUT 50 per cent of all women in the early months of pregnancy suffer from "morning sickness" a feeling of nausea or actual vomiting on first getting up in the morning. It may begin as early as the second week of pregnancy, and is sometimes the first indication that conception has occurred. It usually passes off by the end of the third month or earlier and has little or no ill effect on the general health. Sometimes the vomiting is not confined to the morning but occurs at other times as well and may be independent of the taking of food. It then has a more or less deleterious effect on the health and merits the name "hyperemesis gravidarum" or "pernicious vomiting of pregnancy."

Ætiology Little is known regarding the origin of vomiting of pregnancy. It was formerly believed that many cases were of "reflex" origin—from a retroverted uterus, a rigid cervix, cervicitis, etc., and treatment based on this assumption such as the replacement of a retroverted uterus, the dilatation of a rigid cervix, or the cure of a cervicitis was occasionally followed by cessation of the vomiting. This view is now discarded for while retroversion of the gravid uterus is common it is rare to find vomiting associated with it and on the other hand retroversion is seldom found in cases of hyperemesis gravidarum. The same remarks apply to other "reflex" causes. The following are some of the more modern views —

(1) *The Neurosis Theory* This theory is particularly associated with the name of Carlton Oldfield of Leeds and has recently been revived by Atlee and others. The view is that the vomiting is evidence of a psychological conflict—a rejection tendency or distorted attempt of the unconscious mind to get rid of the embryo, a tendency that is apparently quite compatible with a desire to have a child. There is considerable evidence that at one time the human race thought pregnancy occurred through the mouth, and that this idea still persists. As evidence in favour of the psychological theory Atlee advances (a) the "uniform success" attending the treatment by suggestion, (b) the fact that husbands sometimes vomit. He mentions the case of a man

personally known to him who had typical hyperemesis in each of his wife's three pregnancies, and who was quite convinced in his own mind that his sickness was due to his wife's pregnancies, (c) the frequent evidence of psychological conflict—in sixteen of his thirty three cases. On the other hand, hyperemesis is often present in women who show no other evidence of neurosis or who did not even know they were pregnant. Neither is there any evidence that it is more frequent in unmarried women. There can be little doubt however that a considerable neurotic element is present as an aggravating factor in a large proportion of cases of hyperemesis and on this view is based, as we shall see later, the treatment by isolation.

(2) *The Toxæmic Theory* This view suggests that a toxin is absorbed from the placenta or elsewhere and that it circulates in the maternal blood, if sufficient antibody is not formed to neutralise it poisoning results. Munro Kerr assumes that the toxin is derived from disintegration of the maternal decidua during formation of the implantation cavity. Attempts have been made to furnish antibody by administering serum from normal pregnant women. We shall see later that the more modern view is that toxæmia is not the cause of hyperemesis but that it may arise in the course of prolonged and severe vomiting which has progressed far enough to damage the liver and thus cause retention of toxic metabolic products.

(3) *The Carbohydrate Deficiency Theory* (Duncan and Harding) This theory assumes that the vomiting is due to deficiency of liver glycogen, caused partly by hunger and partly by the demand of the rapidly growing fœtus for carbohydrates. Some clinicians in accordance with this theory attempt to prevent hyperemesis by giving to women in the early weeks of pregnancy frequent small meals with a high carbohydrate content.

Against this view there is the fact that vomiting is not a symptom of hypoglycæmia. Besides, morning nausea is not infrequently one of the earliest signs of pregnancy, occurring immediately after the first missed menstrual period when the ovum is of only microscopic dimensions—less than 1 millimetre in diameter. It is difficult to believe that the large glycogen reserves in the liver can be so far depleted by such a minute ovum as to cause vomiting. There is no doubt, however, that when vomiting has persisted for some time deficiency in glycogen is a serious factor in causing liver damage, and on this experimentally proven

fact is largely based the modern treatment of hyperemesis by intensive carbohydrate therapy

(4) *Endocrine Theories* It has long seemed reasonable to suppose that the changes which are known to be taking place in the entire endocrine system during pregnancy, and especially in its early weeks, might have some causal connection with pregnancy vomiting. It has long been believed for example that in some way a deficiency in the corpus luteum might lead to it and therefore extracts of corpus luteum have been administered extensively in hyperemesis with usually indifferent results. Some of the newer theories are those discussed below —

(a) It has recently been claimed by Schoeneck and others that the urine in hyperemesis even when allowance is made for its greater concentration contains excess of gonadotropic hormone (prolan A and B). We have confirmed this at University College Hospital but so far only on two or three cases. Bandstrup however failed to find any excess in five cases examined. Possibly the excessive excretion of hormone is an indication of abnormal swelling of the anterior pituitary lobe causing a sickness of cerebral origin.

(b) Kemp has recently put forward the view that vomiting of pregnancy is due to a temporary insufficiency of the maternal adrenal cortex. He argues that the earliest signs of cortico adrenal insufficiency in experimental animals are anorexia and vomiting, and that in humans with Addison's disease the earliest clinical symptoms are loss of appetite and morning sickness. In pregnancy there is a greater need for cortin (the secretion of the adrenal cortex) and therefore an insufficiency might arise until such time as the adrenal cortex adequately hypertrophies about the end of the third month. We are informed by Professor T. R. Elliott that, to be of value, at least from 10 to 20 c.c. must be given daily by intramuscular injection.

Pathological Considerations The *liver* changes in fatal cases have hitherto been regarded as very characteristic, the chief being necrosis which starts in the centre of the lobule and spreads towards the periphery. According to Sheehan however this description is not correct. He describes the liver as small and often yellow in colour. Microscopically, fatty changes are sometimes well marked, the cells being filled with fat vacuoles. This may affect the whole lobule or be confined to the area in the centre of the lobule. In some cases it is entirely absent. In the *kidneys*

according to Kellar, Arnott and Matthew the glomeruli are engorged with blood and the tubular epithelium is either much swollen or quite necrotic. It is probable that these changes are of the nature of a toxic nephrosis. The heart is, according to Sheehan small and atrophic, and in some cases there are small subendo-cardial hæmorrhages. Microscopically he could not find any evidence of toxic myocarditis. The atrophic changes probably explain the low blood pressure and the tendency to collapse after operation.

Lesions resembling, if not actually identical with, those of *Wernicke's encephalopathy* have been recently described in the brains of two fatal cases of hyperemesis gravidarum by Campbell and Biggart and in two further cases by Sheehan. They are situated in the brain stem, particularly in the corpora mamillaria and in the grey matter surrounding the third ventricle, and consist in areas of congestion, petechial hæmorrhages and changes in the capillaries—endothelial swelling and bead like dilatations. They may be caused by a toxin originating in the failure of the liver to detoxicate metabolic products, but considerable evidence has been brought forward that they are due to deficiency of vitamin B₁, in which case they may be allied to the polyneuritis that is occasionally associated with cases of severe hyperemesis (p. 416).

It is customary to describe two varieties of hyperemesis, namely, the neurotic and the toxic. In the former the sickness is said to be due to a neurosis, and in its production and perpetuation suggestion is said to play the chief part. The arguments for and against this theory have been reviewed above (p. 297). We shall see later that neurosis is probably a factor of variable importance in all cases. It may even be correct to use the term "neurotic vomiting" in the sense that the neurotic factor predominates in its causation. This does not mean that it is necessarily the sole factor. Furthermore, a case may be "neurotic" in the early stages and "toxic" later.

Quite recently there has been a tendency to regard all cases of hyperemesis as of toxæmic origin. But there is really no support for this view, and chemical studies fail to show, even in many cases in which vomiting has continued for a long time, any disturbance of liver or kidney function such as would be expected if a toxin were responsible.

The following explanation of the occurrences in hyperemesis is probably the most reasonable that can be put forward at the

present time, and is in accordance with modern knowledge derived from experimental work and clinical observation. Besides, it has the advantage that on it can be founded a rational and very successful method of treatment.

It may be supposed that there is some disturbance such as one of those mentioned under ætiology (p. 297) which is the immediate cause of the sickness. If it acts through disturbance of the sympathetic system the vomiting is likely to be more serious in neurotic women, and in some the neurotic factor may even predominate.

When the vomiting, however caused, has continued for some time it leads to deprivation of the glycogen stores in the liver. Now, it has been proved experimentally that simple starvation in animals causes fatty degeneration in the liver, that is, the same change as is found in hyperemesis and that regeneration rapidly occurs if glucose is supplied in ample quantities *provided the damage has not gone too far*. If this has happened, then regeneration may be impossible, and a fatal ending is inevitable, because the liver is unable to absorb and store glycogen.

When, therefore, vomiting has lasted for some time it may cause liver damage. This then sets up a *toxæmia* because the damaged liver cannot detoxicate metabolic products as it normally should, and therefore these are retained in the circulation. The *toxæmia* so caused is aggravated by *dehydration* consequent on the vomiting, and by *constipation* which interferes with elimination. As the liver plays an important part in the oxidation of fats, *acidosis* is set up because of the imperfect fat metabolism. In consequence, too, of the carbohydrate deprivation fat must be burnt up in order to produce energy. In the absence of carbohydrates oxidation of fat is always incomplete, and therefore fatty acids—such as diacetic acid and acetone—appear in the blood and urine. Probably the *acidosis* aggravates the vomiting, and thus a vicious circle is set up. To break this vicious circle is one of the chief aims of treatment.

Keeping in mind, then, that the *toxæmia* in hyperemesis is chiefly due to fatty changes in the liver induced by vomiting, that the vomiting, whatever its cause, is aggravated by neurosis, that the damaged liver regenerates rapidly if glucose is supplied, and that *toxæmia* is aggravated by dehydration and constipation, we can formulate a rational plan of treatment.

Clinical Features Hyperemesis may begin as ordinary morning

ate during those last six weeks ' says one Martha tenderly waited on her mistress and from time to time tried to cheer her with the thought of the baby that was coming ' I daresay I shall be glad sometime,' she would say, ' but I am so ill—so weary——' Then she took to her bed, too weak to sit up Long days and longer nights went by, still the same relentless nausea and faintness, and still borne on in patient trust About the third week in March there was a change A low wandering delirium came on, and in it she begged constantly for food and even for stimulants She swallowed eagerly now but it was too late "

According to Sheehan the metabolic disturbances are never in themselves fatal Apart from operative measures the fatal issue is determined by a special kind of cerebral syndrome which appears to be identical with Wernicke's encephalopathy (p 300) Sheehan describes the general clinical picture of this syndrome as follows "After several weeks of severe hyperemesis, the patient stops vomiting rather suddenly but the pulse rate remains high or increases Then she becomes apathetic or drowsy, and is found to have nystagmus She may become very loquacious or develop tenderness of the legs More marked eye symptoms may develop—squint, retinal hæmorrhages, blindness and so on Sometimes medullary nerve symptoms follow—nasal regurgitation of fluids or hoarseness of the voice Then, after a short phase of mental confusion, the patient goes comatose and dies This clinical condition is so clearly cerebral that the cases are sometimes diagnosed as encephalitis ' Occasionally polyneuritis develops which may be very severe and involve both upper and lower extremities (p 410) Witerman has recently described a case in which polyneuritis was associated with retinal hæmorrhages

Diagnosis This must be made by a consideration of other signs and symptoms of early pregnancy that may be present (p 20) By the time vomiting has become so severe as to require treatment, pregnancy is always well established and the diagnosis should present little difficulty "*Associated vomiting*" that is, vomiting due to some accidentally associated condition, such as gastric ulcer or cancer, cirrhosis of the liver, locomotor ataxy (gastric crises), cerebral tumour, intestinal obstruction, appendicitis, red degeneration in a fibroid tumour, or an ovarian cyst with twisted pedicle, should always be excluded, but perhaps it is commoner to mistake pregnancy vomiting for that due to an associated condition, such as gastric ulcer, and treat it as such

until too late. It should be remembered that the vomit in hyperemesis often contains some fresh or altered blood which may lead to a diagnosis of gastric disease. The blood is probably due to the congestion of the stomach wall caused by the continued sickness. Hyperemesis is sometimes the most outstanding symptom in hydatidiform mole, and in early uniovular twins with severe hydramnios. In exophthalmic goitre starting during pregnancy hyperemesis may be one of the earliest symptoms (p 457). Diagnosis between the non toxic and the toxic types is not always possible, and a case may pass from the first into the second. A diagnosis of toxæmic vomiting may justifiably be made, if in spite of the treatment the vomiting persists and the patient's condition steadily deteriorates. Also, if there is bile in the urine and jaundice, with or without albuminuria, the case is toxic. The blood pressure should be carefully recorded, for a fall in that, which is usually accompanied by a weak and sometimes irregular pulse, gives the earliest indication of myocardial atrophy (see p 300).

Treatment. Based on the conception of the pathology outlined above, a rational treatment can be formulated of which the following are the essentials —

(1) Isolation and suggestion to combat any neurotic element present

(2) To supply carbohydrates in easily assimilable form, such as lactose or glucose, in order to enable the liver to regenerate quickly, and to combat acidosis

(3) To lessen the strain on the liver and kidneys by diminishing the intake of proteins

(4) To diminish acidosis by cutting down the intake of fats

(5) To relieve constipation by purgatives and enemas

(6) To diminish dehydration, and promote diuresis by abundant fluids

(7) To prevent the onset of Wernicke's encephalopathy by daily injections of vitamin B₁

(8) To watch carefully for any signs indicating that pregnancy should be terminated (p 307)

These are the objects aimed at in the following scheme of dietetic and other treatment

Mild Cases (All cases of simple nausea or morning sickness, or those showing occasional vomiting) For three or four days leave out all meats, soups, fish, chicken, butter and cream

Before rising, patient to eat an apple, banana or a few crackers. She must eat plenty of fruit, either fresh or stewed, vegetables, salads, bread, toast, crackers, rusks, may take jams, jellies, honey, custards and sparingly of milk and eggs.

Diet to be taken in five small meals throughout the day.

Fluids Water, weak tea, home made lemonade, to make up to 60 oz a day.

At end of three or four days ordinary diet may be resumed if taken in a number of small meals.

Fats must be taken sparingly.

Attend strictly to the bowels, calomel etc.

Moderate Cases Rest in bed, isolation, no feeding by mouth unless patient feels hungry and asks for food. Cleanse bowels by a simple enema each morning. Give nutrient enema of 6 to 8 oz 10 per cent glucose in saline, three times daily, very slowly by a fine catheter. Fluids by mouth to 60 oz daily.

On subsidence of symptoms commence feeding by a little dry toast or cracker. If well borne, next day give mashed potatoes, a little jam or jelly with toast. Continue to increase the diet by addition of vegetables and fruit until the diet resembles that in mild cases.

Bromide, gr 30, may be added to the night enema if indicated.

Severe Cases Rest in bed with isolation.

No feeding by the mouth.

Treatment as in moderate cases, but give intravenous glucose 1,000 c c 5 per cent solution in saline in addition to nutrient glucose enemas as above. *The intravenous glucose is best given by continuous injection.* A good method is to give 10 pints of 5 per cent glucose in saline at body temperature in forty eight hours by a canula inserted into the saphenous vein just over the internal malleolus. Five units of insulin may be advantageously given with it to prevent loss of the sugar in the urine.

Bromide up to gr 60 may be added to the night enema.

It is a good plan to give an intravenous injection of calcium gluconate (10 c c of a 10 per cent solution) every other day to protect the liver against necrotic changes. The high carbohydrate diet increases the need for vitamin B₁, and this should be kept in mind especially in view of the possibility of polyneuritis (p 416), the cerebral syndrome of Wernicke's encephalopathy (p 303), and of the ocular manifestations previously described (p 302). Injections of this vitamin should be given daily in the form of

aneurine hydrochloride 2 mg subcutaneously intramuscularly or intravenously

Specific Treatment The use of cortin is discussed at p 299. Hawkinson reports favourable results from the use of œstrin. He gives 10 000 units daily in severe cases. Of 50 cases 15 of which were severe 48 were cured but 2 failed to react. Three of the seven cases also received intravenous glucose but the others were treated by œstrin alone.

In all but the mild cases the daily quantity of urine should be measured and recorded. It should be tested daily for bile, albumin and acetone. Acetone is important if present in large quantities as it shows severe acidosis. A record of the daily number of vomits should be kept, and of the amount of each. Blood pressure should be recorded. A careful watch should be kept for dimness of sight (p 302) and the fundus oculi should be examined at short intervals for evidence of optic neuritis or retinal hemorrhages.

Prognosis With this treatment the great majority of patients do well. It is remarkable how quickly patients recover, who have been vomiting for two or three weeks before admission when put to bed and isolated from their friends. Vomiting ceases, the general condition improves and in a few days they are taking almost a normal diet.

Favourable Signs are the following (1) *Cessation of Vomiting* This is good so far as it goes. The cessation of vomiting is not, however, always an indication that the patient is out of danger. She may only vomit, say, once in two days and still be going down hill and ultimately die. This should not be forgotten for otherwise one is liable to be deceived and lulled into a false sense of security by the improvement in this symptom.

(2) *Increase in the Quantity of Urine* This shows not only that fluids are being retained because vomiting is less, but also that the heart is able to maintain the circulation through the kidneys, and is therefore not affected by toxic myocarditis. A fall in the specific gravity of the urine is of equal importance.

(3) *A Slow Regular Pulse of Good Volume* The medical attendant should always feel and count the pulse himself. The chart is apt to be misleading for a nurse may find it difficult to count a rapid thready, and perhaps irregular pulse. Besides, the chart does not record volume and regularity—which are very important.

(4) *A clean moist tongue* is always a good sign. A dry, coated

and cracked tongue is not favourable, and an improvement in this should be looked for from day to day

(5) *Absence of Jaundice* Jaundice should be carefully watched for, as it is a most important danger signal, and usually means that termination of pregnancy is urgently necessary. Sometimes a patient who has jaundice recovers without termination of pregnancy, but many more die because this warning sign is neglected. The conjunctiva should be examined in a good light, and of course in daylight, and it is sometimes necessary to wheel the bed round so as to face the window. It is, however, necessary to observe that a patient may die without being even slightly jaundiced, and jaundice should not be waited for if the general condition is deteriorating. Bandstrup states that it was only noticed in 22 out of 40 fatal cases in Denmark.

(6) *The blood pressure should be recorded twice daily* If normal it is a good sign. If falling it shows that degenerative changes are probably taking place in the heart muscle.

(7) *A normal temperature* is good as far as it goes. It is, however, not often raised even in patients who are doing badly.

(8) *Absence of Bile and Albumin in the Urine* The urine should be tested daily for bile, which is as important as jaundice in indicating the necessity for termination of pregnancy. A simple method of testing is to shake the test tube vigorously when the yellow colour will be seen in the froth. Persistent albuminuria is a bad sign, but it is often absent even in patients who are doing badly, and its occurrence should not be waited for, if termination of pregnancy is indicated on other grounds. Bandstrup reports that it was present in only 12 of 38 fatal cases.

(9) *Absence of any dimness of vision and of the ocular lesions described above* (p. 302)

In a few cases intra uterine death of the foetus occurs and then recovery ensues without further interference.

The remote prognosis in hyperemesis is good. The liver and kidneys recover completely. In severe cases polyneuritis may develop after recovery from the hyperemesis (p. 416), not infrequently the hyperemesis recurs in subsequent pregnancies.

Indications for Terminating Pregnancy. The following should be regarded as indications for terminating pregnancy. They have been already discussed under prognosis —

(1) No improvement in a severe case after a week or less under treatment as outlined above.

- (2) Jaundice, or bile in the urine ¹
- (3) Persistent albuminuria
- (4) A pulse or temperature persistently over 100.
- (5) Persistently low blood pressure
- (6) Optic neuritis or retinal hæmorrhages

Method of Terminating Pregnancy. *The best method is abdominal hysterotomy. The patient must be in very good condition before any other method is justifiable. Chloroform should never be used because of the great danger of further damage to the liver (p. 367). Local anæsthesia (2 per cent. novocaine) is best. The abdominal wall is infiltrated in layers. After infiltrating the peritoneum, 10 minutes should be allowed to elapse before opening it, to allow the anæsthetic to act. This is necessary to avoid shock. For the same reason particular care should be taken to avoid dragging on the peritoneum. The uterus should be infiltrated with the anæsthetic before incising it, and again time should be allowed for it to take effect.*

If necessary a little gas and oxygen should be given rather than risk the least shock, which these patients stand badly. Before opening the uterus pitocin should be injected into its muscle. A small incision is then made on the anterior wall, opening the cavity. The uterus now usually contracts, and squeezes the ovum out entire and without the loss of more than a teaspoonful of blood. The wound is then sutured, and it is a good plan to run a pint or more of saline into the abdomen before closing it. This operation causes no shock and loss of blood is reduced to a minimum.

After operation, the administration of glucose should usually be continued, by whatever route seems best, but in very serious cases always intravenously by the continuous method.

Finally, it is necessary to add that this disease is an extremely insidious one, that the medical attendant is liable to be deceived by apparent slight improvements from day to day, and that operation should not be delayed too long.

Vomiting in Later Pregnancy

Repeated vomiting not infrequently occurs in the later months of pregnancy. It is especially liable to be met with in two condi-

¹ Jaundice is not always in vomiting of pregnancy, an indication of destruction of liver tissue. It is undoubtedly, sometimes a catarrhal jaundice, but clinically the diagnosis between the two is often difficult. Yet the distinction is important for catarrhal jaundice is not an indication for terminating pregnancy. The general state of the patient must be taken into account. If this is good, the jaundice may properly be regarded as catarrhal and medical treatment may then be continued.

tions, namely, pyelitis of pregnancy and severe pre eclamptic toxæmia. The treatment is that of the causal condition. Associated vomiting (due to some cause such as appendicitis, associated with but not due to the pregnancy) must be excluded. In acute yellow atrophy of the liver (p 366) vomiting is usually an outstanding feature.

REFERENCES

- ATLEE, H B *Jour Obst and Gyn Brit Emp* 1934, 41, 750⁶
 BALLANTYNE A J *Jour Obst and Gyn Brit Emp* 1941 48 206
 BANDSTRUP LBBF *Jour Obst and Gyn Brit Emp* 1939 46, 700
 CAMPBELL A C P and BIGGART, J H *Jour Path and Bact* 1939 48 245
 DUNCAN J W and HARDING, VICTOR J *Canad. Med. Assoc Jour* 1918 8, 1057
 FITZGERALD, J E, and WEBSTER A *Am Jour Obst and Gyn* 1938 36 460
 HAWKINSON L I *Minnesota Medicine* 1936 19, 510
 HAWKINSON, L I *J A M A*, 1938 111, 1235
 KELLAR, R J, ARNOTT, W M, and MATTHEW G D *Jour Obst and Gyn Brit Emp*, 1937, 44, 320
 KEMP, W N *Medical Record* 1934 140 239
 KERR J M MUNRO *Trans Edin Obst Soc* 1931 2, 52 52
 OLDFIELD CARLTON *Brit Med Jour* 1922 i ~89
 SCHONECK, I J *Amer Jour Obst and Gyn* 1936, 32, 104
 SHEEHAN, H L *Proc Roy Soc Med London* 1939 32, 584
 SHEEHAN, H L *Jour Obst & Gyn Brit Emp* 1938, 46, 685
 WATERMAN, J A *Jour Obst & Gyn Brit Emp* 1939 46 70

CHAPTER XXI

THE TOXÆMIAS OF LATE PRÉGNANCY

A CONVENIENT and simple classification of the toxæmias characteristic of the later months of pregnancy (as distinguished from toxæmic hyperemesis gravidarum, which usually occurs in the first three months) is as follows

- (1) *Pre-eclamptic toxæmia and eclampsia*
- (2) *Chronic glomerular nephritis in pregnancy*
- (3) *Essential hypertension in pregnancy*
- (4) *Acute yellow atrophy of the liver*

It will be observed that the so called "low reserve kidney" is not included in the above classification, as we believe it is simply a mild form of pre eclamptic toxæmia. In a recent study of this condition by Herrick and Tillman, in which 188 cases were followed up for from one to twenty four years, it was found that 63 (33.5 per cent) showed hypertension as well as other *stigmata of cardiovascular disease, such as retinal sclerosis, thickening of the brachial vessels, cardiac enlargement, headache, dyspnœa, etc*, while post mortem examination of a typical case that died fifteen years after the first pregnancy that had been complicated by "low reserve kidney" showed the cause of death to be *generalised arteriolosclerosis and arteriolo nephro sclerosis*. Very similar was the experience of Peckham and Stout, who in 1936 reviewed all the cases of "low reserve kidney" in the Johns Hopkins Clinic. They found that at the end of five years one half had developed persistent hypertension.

Pre-eclamptic Toxæmia and Eclampsia

The term "pre eclamptic toxæmia" is used here instead of the older term "albuminuria of pregnancy," because the latter term pushed into the foreground of the clinical picture a sign, the albuminuria, which is not always present, and which in any case is rarely present at an early stage of the disease. The use of this term has probably done more than anything else to hinder the early diagnosis of pre eclamptic toxæmia. The practitioner, watching his patient for the onset of "albuminuria of pregnancy," not unnaturally expects to find albumin in the urine in every case, and as the earliest danger signal, whereas the truth is that the patient

may be in imminent danger of eclampsia though the urine is perfectly normal. Pre eclamptic toxæmia may therefore be defined as "a condition occurring in pregnant women, characterised chiefly by a rise of blood pressure, œdema and albumin in the urine, and often ending in convulsions."

Ætiology Any satisfactory theory of the origin of eclampsia must explain the following amongst other facts

- (1) It occurs only in pregnancy or shortly after delivery
- (2) It occurs chiefly in primigravida (70 per cent.)
- (3) It may occur in hydatidiform mole, where there is no fœtus. Indeed pre eclamptic toxæmia is relatively much more frequent in this condition than it is in normal pregnancy (p. 188)
- (4) It is not infrequently associated with concealed accidental hæmorrhage
- (5) It is sometimes associated with bilateral cortical necrosis of the kidneys (p. 327)
- (6) It may set in for the first time a few hours or more after delivery

In these respects none of the current theories is entirely satisfactory, but the following are some of the best known

(a) *The Intestinal Toxin Theory* (Tweedy, 1913) Toxic protein derivatives normally enter the blood stream from the intestines but are neutralised by antibodies. During pregnancy the antibodies also have to neutralise products of placental and fœtal metabolism and they may be insufficient for both purposes, so that protein poisoning results. This is often known as the Dublin theory and was first promulgated by Tweedy in 1913. The treatment by low protein diet is largely based on it.

(b) *The Placental Theory* (Young, 1914) Infarction of the placenta occurs for some reason, and from the dead or 'infarcted' placental tissue toxic substances of great potency are absorbed into the maternal blood. In this way Young explains the frequent association of red infarcts of the placenta with eclampsia and pre eclamptic toxæmia. Most, however, hold that the infarction is a result, not the cause, of eclampsia.

(c) *The Water poisoning Theory* (Zangemeister, 1915) Zangemeister held that in pregnancy there is an increased retention of water in the body because of greater permeability of the capillaries which was, he believed, due to a toxin. Œdema of the brain renders it anæmic so that the brain cells are under nourished and the

irritability so caused leads to convulsions. The rise in blood pressure is due to increased intracranial pressure, which stimulates the vasomotor centre. The edema also leads to an "ischemic albuminuria" by causing swelling of the kidney within its rigid capsule rendering it anemic. It will be observed that this theory does not explain the origin of the toxin which he considered responsible for the edema. Strauss believes that the edema is caused not by increased permeability of the capillaries, but by lowered osmotic pressure of the plasma proteins together with increased venous pressure. The former he suggests, is due to a low protein intake in the food and the latter possibly to the mechanical effect of the enlarged uterus, which one would expect to be most marked in primigravidae with taut abdominal walls, in obese stockily built women and in women with very large uterus from twin pregnancy or hydramnios. Dieckmann and Kramer however failed to find any significant lowering in the serum protein or in the albumin globulin ratio of patients with pre-eclamptic toxemia or eclampsia as compared with normal controls. Whatever is the cause of edema in these conditions it is not in their opinion hypoproteinemias. Thorn Nelson and Thorn produced edema in dogs by injecting estrin but we shall see later that in pre-eclamptic toxemia and eclampsia estrin is diminished. Finally there is the work of Rowntree on water intoxication. He showed that by giving 50 c.c. of water per kilo. of body weight to a dog every half hour he could produce asthenia, restlessness, nausea, vomiting, muscle twitching, tonic and clonic convulsions, coma and death in a few hours. There was an increase in weight of 20 to 30 per cent. The only post mortem changes found were edema of the connective tissues, liver, kidneys, and brain. Rowntree was able to demonstrate increased intracranial pressure during life and he believes this to be the cause of the convulsions. Weir Larson and Rowntree in a similar experiment demonstrated a rise of blood pressure from 140 to 200 mm. Hg or over.

While Zangemeister's theory is attractive, it must be remembered that in many cases of eclampsia there is no clinical edema, nor even latent edema, demonstrable by abnormal increase in weight (p. 334).

(d) *Increased Intra-abdominal Pressure Theory (Paramore).* Paramore holds that the increased intra-abdominal pressure of pregnancy leads to alteration in the circulatory conditions in the

liver and kidneys and degenerative changes in their parenchyma. This theory therefore offers an explanation of the greater frequency of pre-eclamptic toxæmia in primigravida. Its possible importance should be considered afresh in relation to the new work by Goldblatt and others on ischæmia of the kidney as a cause of hypertension.

(c) *Dietetic Deficiency Theory* (Theobald 1930) Theobald in 1930 advanced the hypothesis that all the major and minor toxæmias of pregnancy are expressions of dietetic deficiencies and may be regarded as relative deficiency diseases. A diet apparently

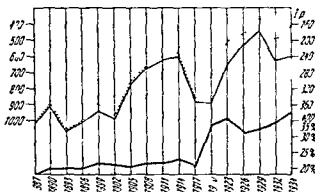


FIG. 48. Showing incidence of eclampsia in Baden and correction of eclampsia curve rendered necessary by the relative increase of primiparae since 1918.

Dotted line Eclampsia curve without correction.

Upper continuous line Eclampsia curve after correction.

Lower continuous line Percentage of primiparae among child bearing women from 1887 to 1934.

adequate for the mother is no longer adequate for the mother and foetus. While he believes that deficiency of the different vitamins and minerals all play a part, he maintains that disturbance of the calcium metabolism is the most important single factor involved. This hypothesis, clearly capable of proof or disproof, relates morning sickness, hyperemesis gravidarum and excessive salivation to eclampsia, accidental hæmorrhage, and acute yellow atrophy of the liver. One difficulty in accepting this view is the fact that in Germany during the last two years of the war of 1914-18, when the civil population was grossly underfed, the incidence of eclampsia fell to 0.6 per 1000 births as compared with 2.0 per 1000 just before the war (Gessner). Accurate figures regarding this fall can be obtained from Baden in Germany,

where eclampsia has been notifiable for many years. These have been analysed recently by Baader (Fig 48), who shows that during the war years the drop occurred steadily till 1918 after which there was a rapid increase. Baader shows, however, that the increase in 1919 and 1920 was due to the greater proportion of primiparæ in the child bearing population, and that when allowance was made for this by assuming that primiparæ are four times more likely than multiparæ to become eclamptic, the fall really continued till the end of 1920, during which period the effect of the blockade was still being felt.

While this fall in the incidence of eclampsia has generally been attributed to the decreased consumption of flesh and fat, other explanations have been put forward. It is noteworthy, for example, that during the war years there was no fall in the *mortality* from eclampsia which continued as before to account for one death in every 4 000 births. This might possibly be due, as Baader suggests, to the slighter cases of eclampsia having been overlooked on account of the scarcity of doctors, so that only the more severe, and therefore more obvious cases were reported by the midwives. Another factor may have been the more widespread employment of women in hard muscular work up till the time of delivery (Gessner) and especially in the open air and sunshine, though this cannot explain the continued fall during the years 1919 and 1920 as according to Gessner, most young women gave up their war work at the end of the war in 1918.

Theobald claims that the more animal protein there is in the diet the greater must be the intake of calcium and vitamins B and D in order to protect against its toxic effects. He has reported the results of the prophylactic administration of calcium and vitamins A and D to antenatal patients. Apparently healthy women not more than 24 weeks pregnant, were divided at random into two groups, those in group A being requested to take daily for the remainder of their pregnancies 11,000 international units of vitamin A, and 450 units of vitamin D, together with calcium lactate gr 20, group B serving as controls. One hundred women were included in the experiment, 50 in each group. Seven in group A and 17 in group B suffered from hypertension (B P 140 mm Hg or above) with or without albuminuria. These results are statistically significant. Mendenhall and Drake found that only 2 out of 188 (1 per cent) women to whom calcium was administered in pregnancy developed toxæmia whereas in a control

series of 230 women to whom calcium was not given, 80 (13 per cent) became toxic. On the other hand, there is no higher incidence of eclampsia or of pre eclamptic toxæmia in women suffering from osteomalacia or its minor manifestations. In this connection the work of Minot and Cutler is of great interest. They found that dogs were highly susceptible to carbon tetrachloride poisoning if kept on a diet low in calcium, viz. lean meat without bones but that they were immune to the poison if given a diet high in calcium and carbohydrate for three weeks before the poison was administered. If convulsions which often follow carbon tetrachloride poisoning had developed the injection of calcium salts brought about rapid recovery. Yet the serum calcium was found to be normal. The deficiency is probably in the ionised calcium only. Theobald too, produced fatal liver necrosis in pregnant cats by keeping them on a diet deficient in calcium, and without the administration of any poison.

It may be significant that in the last (1940) Annual Report of the Department of Obstetrics and Gynaecology of the University of Hong Kong Gordon King reports 155 cases of avitaminosis B₁ (beri beri) complicating pregnancy and labour, 135 (87 per cent) of which had a blood pressure exceeding 180/70 including 16 cases of eclampsia. Assuming that the usual incidence of eclampsia is 1 in 500 it is apparent that the incidence in avitaminosis B₁ is increased fifty times. Siddall also impressed by the high incidence of pre eclamptic toxæmia and eclampsia in Canton where beri beri occurs very frequently, believes that B₁ deficiency in pregnancy leads to compensatory hyperfunction of the pituitary with disturbed carbohydrate metabolism œdema raised blood pressure, etc. Ross *et al* carried out a study of the effect of diet on the incidence of toxæmia of pregnancy in a group of young primiparæ who were resident in a charitable institution and whose diet could therefore be carefully supervised. In the experiment 53 patients were observed 27 of whom had the ordinary diet of the institution, which was judged to be adequate for the needs of pregnancy, supplemented by the additions of dried milk, vitamins A, B and D, calcium phosphorus and iron. Alternate patients, 26 in number, receiving the ordinary diet only and therefore being used as controls. The incidence of toxæmia in the supplemented group was 33 per cent while in the controls it was 42 per cent. The authors concluded that the extra diet had no appreciable effect.

Cope failed to find any diminution of pregnandiol in toxæmic cases (*cf. infra*)

Byrom has produced lesions in albino rats closely resembling those of eclampsia—focal necrosis of the liver and symmetrical cortical necrosis in the kidneys (p. 327) by injecting vaso pressin. He believed the lesions to be due to arterial spasm. He also found that the sensitivity of the rat to vasopressin could be increased ten times by preliminary treatment with oestrogenic hormone, and that in unsprayed rats the sensitisation could equally well be brought about by gonadotropic hormones. The sensitisation could not be prevented by the simultaneous administration of progesterone. In relation to these results the observations of Schockaert and Lambillon are of great interest. These workers found that if a pressor substance *eg* tonephin was injected intravenously into (a) a normal non pregnant woman (b) a normal pregnant woman in the last three months and (c) a woman suffering from pre eclamptic toxæmia the degrees of reaction obtained were not the same. In (a) the systolic blood pressure rose 30 to 60 mm Hg, the mean being 45 mm and there were very severe subjective phenomena. In (b) the rise was very slight and varied from 0 to 22 mm the mean being 13 mm. In (c) a rise of 35 to 80 mm occurred mean 55 mm. Results which were very similar were obtained independently by Dieckmann and Michel who however used pituitrin subcutaneously and later by de Valera and Kellar using tonephin intravenously. It may be useful to compare the three sets of observations —

	Schockaert and Lambillon	Dieckmann and Michel	de Valera and Kellar
Normal non pregnant	45 mm	Little or none	35 mm
Normal pregnant	13 "	11 mm	27 "
Pre eclamptic toxæmia	55	51	48

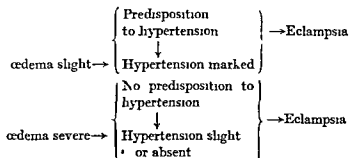
Two possibilities are suggested by these results. (1) That patients who have pre eclamptic toxæmia are sensitised to the pressor substance by oestrin. But Smith and Smith and Taylor and Scadron have found low oestrin values in the blood and urine of such patients. (2) That there is in the normal pregnant woman an inhibiting substance which is lacking in the non pregnant and in patients with pre eclamptic toxæmia. Robson and Paterson

pregnant women " In 7 per cent of those with such œdema he noted symptoms such as frontal headache visual disturbances nausea and vomiting How such œdema is caused is still a matter for speculation We have already seen that it is not due to a hypoproteinæmia It may be that there is an increase in circulating antidiuretic hormone and it will be recalled that Theobald found such an increase in the blood of eclamptic patients We have seen too (p 312) that œdema can be produced experimentally by injection of œstrin and as œstrin is produced by the placenta, and as its concentration in the circulation increases as pregnancy advances, it might well be regarded as the cause of œdema in pregnancy and pre-eclamptic toxæmia All the investigations on the œstrin content of the blood and urine in toxæmia however, show that it is diminished or at least not increased (p 316) Again the œdema might be due to a dietetic deficiency, though of what nature is not clear We have already noted (p 315) that in the Annual Report of the Department of Obstetrics and Gynecology of the University of Hong Kong 1940 Gordon King reports 155 cases of avitaminosis B₁ complicating pregnancy and labour, 135 (87 per cent) of which had a blood pressure exceeding 130/70 Another possible cause of renal ischæmia is increased intra abdominal pressure (Paramore p 312) though Theobald (1932) failed to find any increase of intra abdominal pressure in pregnancy It is conceivable that dilatation of the ureters renal pelvis and collecting tubules might render the kidney ischæmic, though no correlation seems to have been yet attempted between such changes and pre-eclamptic toxæmia or eclampsia Though advanced nephrosclerosis resulting from old standing pyelo nephritis can give rise to hypertension there is no evidence that hypertension exists in the earlier stages of pyelitis, which is always associated with dilatation of the ureter and kidney pelvis

It has long seemed to the author that, whatever might ultimately be found to be the exciting cause of eclampsia an important predisposing cause was a familial predisposition to hypertension This received support from the results of the cold pressor tests carried out by him (p 338) which showed that the patient who started pregnancy with a high basic blood pressure was more likely to develop pre-eclamptic toxæmia than one in whom it was low

From a consideration of all the evidence experimental and

clinical the following conception of the ætiology of eclampsia is tentatively offered. Œdema and hypertension are both of the greatest importance in its causation and they are complementary to each other. Thus eclampsia may arise when there is a sudden large rise of blood pressure with little œdema, or it may arise if there is much œdema with little or no hypertension, a familial predisposition to hypertension may result in a very great rise of blood pressure even when there is little œdema, and the absence of a familial predisposition may prevent any marked rise when there is much œdema. These ideas may be presented schematically thus



It is suggested that the exciting cause of the eclamptic convulsions is the injury to brain cells brought about by ischæmia the ischæmia being caused by œdema and hypertension.

Albuminuria is the result of renal ischæmia with consequent glomerular injury, the ischæmia being brought about either by œdema or by functional constriction of the afferent glomerular arteries. It may occur with little or no rise of blood pressure, but if blood pressure is low, œdema must be correspondingly great. In any case its occurrence is merely incidental and bears no ætiological relationship to the outbreak of eclamptic convulsions.

Clinically, twins predispose to eclampsia. Eden found that in 1,524 cases of eclampsia the incidence of twins was 4.7 per cent. The average incidence of twins is about 1 per cent, so the liability to eclampsia in twin pregnancy is four or five times that in single pregnancy. Guttmacher's experience was similar, in a series of 573 twin deliveries at Johns Hopkins Hospital the incidence of eclampsia was 4½ times that in all viable pregnancies. It occurs more often in primigravidae (70 per cent) than in multiparæ (30 per cent) and as the number of primigravidae is only a fraction

of the multiparae the liability to eclampsia is enormously higher in first as compared with subsequent pregnancies. It is said, too, that stout women of stocky build are more prone to develop the disease.

Pyelitis and Toxaemia Peters has in recent years claimed that pyelitis and pyelonephritis are important factors in the causation of pre-eclamptic toxæmia and eclampsia. Of 93 patients with pyelitis complicating pregnancy, 25 developed before the end of pregnancy hypertension or œdema or both, and of 320 patients with toxæmia 41 had pyelitis. Further, of 25 autopsied patients with vascular or renal disease that first manifested itself during pregnancy 11 were found to have pyelitis and hydronephrosis. If this work is confirmed it must be considered in relation to the experiments of Goldblatt and others who by partial occlusion of one renal artery caused chronic hypertension and to the experiments of Dill and Erickson, previously referred to (p. 318). Clearly pyelitis and pyelonephritis would have a similar effect in that by destruction of renal tissue they diminish the circulation through the kidney. McLane, however, failed to find any higher incidence of toxæmia amongst his cases of pyelitis. The incidence was 10 per cent. amongst 98 cases of proved ante partum pyelitis which was the same as in the whole clinic population.

Frequency of Eclampsia It is not possible to obtain accurate figures regarding this in Great Britain as eclampsia is not notifiable. Resort can only be had to hospital statistics which rarely give a true picture. Eclampsia is however notifiable in three

TABLE VII *Showing Incidence of Eclampsia in the large Towns and Country Districts of Saxony during ten Years (Modified from Küstner)*

Year	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	Average for the ten years
Large towns	1 in 550	1 in 480	1 in 410	1 in 420	1 in 430	1 in 310	1 in 300	1 in 300	1 in 200	1 in 330	1 in 380
Country districts	1 in 750	1 in 770	1 in 600	1 in 700	1 in 620	1 in 450	1 in 400	1 in 430	1 in 360	1 in 450	1 in 580

German states, i.e., Hamburg, Saxony and Baden and from them we find that the incidence though there have been considerable variations in recent years, averages about 1 in every 430 deliveries.

The incidence in country districts is only about two thirds to three-quarters that in large towns (see Table VII), and this difference which seems to prevail in all countries, is generally attributed to three factors (a) the relative cheapness and accessibility of carbohydrate and vegetable foods and green stuffs in country districts so that less butcher meat is consumed than in large towns, (b) the beneficial effect of sunshine on women engaged on work in the open air as compared with factory workers in cities, and (c) the hard muscular work that country women do in the fields and elsewhere

Geographical Distribution of Eclampsia. As eclampsia is rarely notifiable (for an exception see p. 321), data regarding its incidence in different countries are almost entirely derived from hospital figures, and are therefore unreliable. But there seems to be no reason to believe that the incidence varies significantly in civilised countries throughout the world. Dieckmann states that it is unknown or very rare among the natives of Kenya, Uganda, Zululand Tanganyika, Belgian Congo, Ethiopia, Persia, Java, Hawaii, British Malaya, Alaska, Australia and the date oases of Africa, where the habits and diet have not been changed by contact with the white races. It is common, on the other hand, among the natives of Algiers, Cape Town, Colombo and Porto Rico, where they have adopted many if not all of the dietetic and other habits of the whites. It is of interest too that while it is rare among the African negroes in whom hypertension apart from pregnancy is uncommon, it is frequent among the negroes of the United States of America in whom hypertension is common. We have already seen that the incidence is much less in rural than in urban areas, but the cause of the relative immunity in country districts is not known with certainty. After examining the literature on the geographical incidence of eclampsia one is left with the impression that there is great need for more accurate and extensive information, and that this is unlikely to be obtained unless the disease is made notifiable in all countries.

Influence of Climate in causing Eclamptic Attacks. Regarding this there is no general agreement. The following have been blamed for precipitating attacks in predisposed or in pre eclamptic persons: hot damp climate by interference with water balance (Dieckmann), cold damp weather (Lennon), rapid changes of temperature by preventing efficient action of the skin (Crichton), quick changes in the weather from hot to cold or cold to hot, by

causing electrical disturbances in the atmosphere that lead to hyperexcitability of the vegetative nervous system (Louros). Many more observations are necessary before the matter can be settled.

Pathological Considerations Generally speaking, the changes in the organs are, as shown by Schmorl, of the nature of thromboses of capillaries and smaller veins and occasionally of arterioles, with hemorrhages and necroses in the areas immediately surrounding them.

The Liver The changes in the liver are so characteristic that in themselves they are sufficient to warrant a post mortem diagnosis of eclampsia.

To the naked eye the surface usually appears smooth and is mottled by numerous scattered areas of subcapsular hemorrhage. Between these the colour may be normal or may be pale yellow either from fatty change or jaundice. The cut surface shows similar scattered hemorrhages.

Microscopically the changes are still more characteristic. Before we can understand their genesis and distribution we must have clear views regarding the blood supply and circulation in the liver, and this we shall briefly call to mind. The liver receives blood from two main sources—(a) the portal vein and (b) the hepatic artery. The portal vein though it drains chiefly the intestine also gets blood from the uterine veins via the superior hemorrhoidal vein. In the interlobular septa (Glisson's capsule) the portal vein breaks up into capillaries which flow into the sinusoids of the liver and ultimately into the central venules of the liver lobules and so into the hepatic veins which enter the inferior vena cava. The hepatic artery supplies chiefly Glisson's capsule, including the interlobular septa. In the septa it breaks up into capillaries which again reunite to form small veins that anastomose in the septa with the branches of the portal vein. The sinusoids therefore have a double blood supply—namely, a main one from the portal system and a subsidiary one from the hepatic artery. So it will be apparent that if there is a toxin derived from the uterine contents it is likely to reach the liver directly by way of the portal vein and this may explain why it is that the liver is usually more severely damaged than any other organ. Another reason may be that the flow through the portal vein and the liver sinusoids is slow, so that there is more time for the hypothetical toxin to act on the capillaries and liver cells.

So far as they have been observed the chief changes in the liver in eclampsia are as follows

(1) *Fibrinous thrombi in the portal capillaries* in the periphery of the lobules (Fig 49) Fahr regards this as the most characteristic and constant change. Furthermore, it is never present in any other condition

(2) *Stasis of the blood in the portal capillaries* (Fig 50) This, unlike the fibrinous thrombosis, is not peculiar to eclampsia and may be found in several other conditions, such as diphtheria.

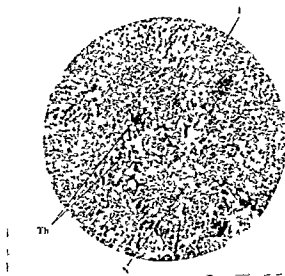


FIG 49 Eclamptic liver. Shows liver necroses (N) and capillary thrombi (Th). L = Normal liver cells (Fahr)

The result of it is that the sinusoids become widened, and therefore may cause pressure atrophy of the liver cells surrounding them

(3) The walls of the capillaries (sinusoids) may give way, leading to *hæmorrhage amongst the liver cells*, which, being thus torn apart from each other, undergo necrosis (*hæmorrhagic necrosis*) (Fig 50). These areas of hæmorrhage and necrosis are very numerous in the eclamptic liver and are situated, if small, in the peripheral part of the lobule, but if more extensive, may involve the entire lobule, including its central portion. They are temperature by the darkly mottled hæmorrhagic areas described quick changes in the naked eye underneath the capsule and on the

cut surface. Like capillary stasis they are not, however, peculiar to eclampsia but may be found in other conditions, such as diphtheria, and Fahr has produced them experimentally in dogs by injecting adrenalin.

(4) *Areas of Dry (Non hæmorrhagic or Anæmic) Necrosis*
These are much rarer than hæmorrhagic necrosis and are probably

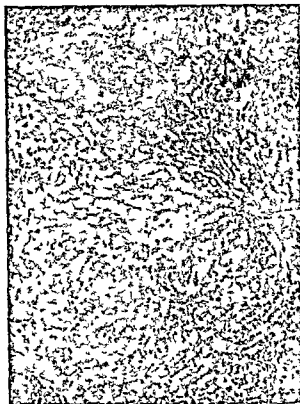


FIG. 50. Eclamptic liver showing capillary stasis. Towards the upper right hand corner there is also an area of hæmorrhagic necrosis.

due to the direct action of the toxin on the liver cells without any previous vascular damage. They are not characteristic and may be found in patients who have died of diphtheria.

(5) *Fatty Degeneration of the Liver Cells*. This is variable in amount and is not, as a rule, of great importance, it may be diffuse, affecting all the cells to an equal extent, or only groups of cells here and there may be concerned.

The cause of the above mentioned changes it is impossible at present to determine. A possible explanation is that there is a toxin in eclampsia which attacks the endothelium of the blood vessels thus causing the formation of the fibrinous thrombi in the capillaries or again destroying their walls completely and so leading to hemorrhage. If this is the explanation it is easy

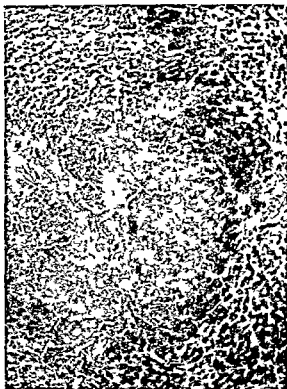


FIG. 31. Eclamptic liver. Shows how the necrotic areas are situated at the periphery of the lobule around the interlobular septa, one of which is seen a little to the left of the centre and contains a small bile duct.

to see why the periphery of the lobules should bear the brunt of the attack and thus come to be the chief site of the hemorrhagic necrosis. In view of Fahr's adrenalin experiment capillary spasm must also be considered as a possible cause. Byrom produced focal necrosis in the liver of rats by injecting vasopressin. It is certain that the changes are *not* due to the eclamptic convulsions, as some observers have claimed, for they may be found when fits have never

occurred—the so-called ‘eclampsism’ or eclampsia without fits. The somewhat similar changes found in the brain in Wernicke’s encephalopathy have been discussed under hyperemesis (p. 300) and we have there seen that there is considerable evidence pointing to vitamin B₁ deficiency as an etiological factor.

The kidneys are usually slightly enlarged and their surfaces smooth. *Microscopically* the characteristic lesion is in the glomeruli. There is marked thickening of the basement membrane of the glomerular capillaries and sometimes swelling of their endothelial cells. These changes necessarily lead to narrowing of the capillary lumen and therefore make the glomeruli anæmic (Bell Fahr Shaw Dunn and Baird). The glomeruli are also more permeable and thus allow albumin to escape though the anatomical basis for the increased permeability is not apparent. This glomerular lesion is quite different from that found in ordinary glomerular nephritis but opinion differs as to whether it is degenerative or inflammatory. It is probably best regarded as a response to a stimulus of some kind. According to Bell the thickened basement membrane is not a homogeneous structure merely thickened by œdema or hyaline change but is composed of fibres laid down in parallel layers representing an actual increase in substance. The swelling of the endothelial cells is in Bell’s view probably due to a toxic substance but the nature of the stimulus leading to thickening of the basement membrane is more doubtful. It may be a reaction to increased intra-vascular pressure (Vollhardt) but as Bell found similar changes in a case of hyperemesis gravidarum and in another of lipoid nephrosis both unaccompanied by hypertension this explanation seems to be inadequate. The alternative is that a soluble toxin is responsible. For a useful discussion of the whole matter Bell’s paper should be consulted.

Degeneration of the tubular epithelium is sometimes present and varies from a mild cloudy swelling to complete necrosis. Casts are numerous (Keller Arrott and Matthews). The possible part played by lordosis and consequent compression of the left renal vein in the production of orthostatic albuminuria is discussed later (p. 311) in connection with the observations of Frank Cook.

Symmetrical Cortical Necrosis of the Kidneys. This is a somewhat rare condition that is usually associated with eclampsia or

concealed accidental hæmorrhage, or with both, though it has also been recorded in patients with scarlet fever, diphtheria, pulmonary tuberculosis, dysentery, pneumonia, and in diethylene dioxide (dioxan) poisoning (Barber). The cortex of both kidneys shows necrosis which may involve almost the whole cortex or only patches of it. Around the necrotic areas there is exudation and hæmorrhage, and in the afferent arteries of the glomeruli and the interlobular arteries there is thrombosis. For some days after its onset the patient usually feels fairly well, though there is more or less complete anuria, and the kidneys may be tender, but gradually œdema supervenes, with attacks of dyspnoea, muscular twitching, vomiting, drowsiness, delirium, coma and death, which usually takes place in ten to twenty days, though some of the milder cases may recover. A constant feature is a rising blood urea which may reach 300 mg per cent or more before death.

The cause of the condition is not finally determined but the following are the most important views. (1) That the necrosis is due to spasm of the smaller terminal arterioles of the kidney, with resulting ischæmia and necrosis. This explanation receives support from the observation that in one of Jardine's cases there was also Raynaud's disease. Against it is the statement that the blood pressure is not always raised (Kellar and Arnott). It would, however, explain the well known association with concealed accidental hæmorrhage (p. 245). Byrom (1937) produced massive cortical necrosis in albino rats by injecting 20 to 40 units of vasopressin. The vessels in and around the necrosed areas were

glomeruli are end arteries and the arteries of the uterus are not (4) Scriver and Oertel believe that the cause is a vaso paralysis of the terminal arterial segment with blood stasis exudation hæmorrhage and finally thrombosis. This vascular disturbance is in their opinion related to a general vaso motor irritability incidental to the pregnant state (hypertension). They thus relate bilateral cortical necrosis of the kidneys to the necroses and hæmorrhages that we have already seen are found in the liver, brain and other organs in eclampsia and to concealed accidental hæmorrhage.

Treatment is unsatisfactory. The bowels should be opened and free sweating procured. Diuretics are advisable and one of the best is an isotonic solution of crystalline sodium sulphate 42.85 grams per litre given intravenously in large amounts. Clifford White believing that the kidney is swollen and under tension within its rigid capsule advocates incision of the capsule of one kidney along its free border. If this procedure is to have any chance of success it must be done early—within the first forty eight hours and in a condition where medical measures hold out so little hope of success it should be tried in every case.

In the *central nervous system* the only constant change is cerebral anæmia. There is often marked œdema of the brain and meninges. Thrombi in capillaries and venules with multiple microscopic hæmorrhages and small areas of softening around them are common and have a preference for the cortex and central ganglia. The softenings are mostly around small arterioles whose walls have undergone hyaline degeneration or where a large number of capillaries are thrombosed. Sometimes hæmorrhage is very extensive involves the basal ganglia and is the immediate cause of death.

In the *heart* degenerative changes in the myocardium are almost always present with cloudy swelling of the muscle. Fatty degeneration is present in long standing cases. Thrombi in the capillaries and small veins and even in the arterioles with small hæmorrhages are frequent.

In the *lungs* catarrhal pneumonia is common. Sometimes lung abscesses are found and are due to inhalation of infected matter. Hæmorrhages are often found and vary in size from a pea to a cherry. They may be subpleural or in the centre of the lobe. Thrombi are frequent in capillaries and small arteries and veins. Synechial masses sometimes block the veins and were believed

feet and ankles and later the legs face hands abdominal wall and vulva (Figs 52 and 53) The albumin may be a mere trace at first but may increase rapidly until the urine boils solid The œdema and albuminuria usually increase *pari passu* When these become marked other symptoms appear *z.e.* oliguria headache giddiness and vomiting (from increased intracranial pressure) Headache is usually frontal or occipital and is often very severe Dimness of sight diplopia flashes of light before the eyes partial loss of consciousness and epigastric pains follow These are serious symptoms and with headache and high blood pressure with or without œdema usually indicate that the onset of eclamptic



FIG. 53. (Edema of the vulva in pre eclamptic toxæmia)

convulsions is imminent The blood pressure at this stage may reach as high as 220/140 Urine diminishes as œdema increases and may be scanty or even completely suppressed It contains in addition to albumin casts (hyaline epithelial and granular) and sometimes blood and bile

While œdema and albuminuria are usually present in pre eclamptic toxæmia they may both be absent and even eclamptic convulsions may occur without either having been present In such cases the most important sign of impending convulsions is a rapidly rising blood pressure We believe however that if œdema is absent a much higher blood pressure (usually 200 or over) is necessary to cause convulsions than if œdema is present and conversely, that if œdema is marked eclamptic convulsions may occur with a relatively low blood pressure

It is worth noting that an *early rise of blood pressure* may occur—even as early as the 2nd or 3rd month of pregnancy—followed by a more or less prolonged interval during which the blood pressure is normal, and then by a permanent rise, and other signs of toxæmia. This “*early warning rise*” of blood pressure is important, as if found it is an indication that trouble is to be expected later on.

Changes in the Fundus Oculi The earliest and most important change is a constriction and narrowing of the arterioles of the retina, which, according to Wagener, may affect any or all of the branches of the central artery. Masters states that it is present in all cases of pre eclamptic toxæmia where the blood pressure is above 150 systolic and 100 diastolic. This narrowing is often accompanied or followed by irregular constrictions of the lumen of the arterioles, usually most marked at first in the smaller nasal branches, and varying in degree and location from day to day. Later on the constrictions become more fixed, and finally the cotton-wool patches and hæmorrhages characteristic of albuminuric retinitis may appear. The relation of the albuminuric retinitis to the spasmodic contractions is not finally determined. Mylius believes that the spasm leads to the retinitis by causing anoxæmia and consequent necrosis of the vessel wall, so that when passive congestion occurs it gives way with resulting hæmorrhage and exudation. Friedenwald, on the other hand, states that when albuminuric retinitis exists there is always a pre-existing arteriolar sclerosis affecting the terminal arterioles and the capillaries—an acute necrosis of the vessel wall, with total disappearance of all cellular outlines, and replacement of the tissues by an amorphous protein lipid containing coagulum, called, for want of a better name, “hyalin.” According to this view, therefore, albuminuric retinitis is essentially an arterio sclerotic retinitis, and the retinal lesions are minute foci of necrosis, œdema and hæmorrhage, dependent on vascular occlusion, and interference with nutrition following thereupon.

Such are the two opposing views. Wagener, after consideration of the whole matter, concludes as follows: “It does not seem feasible at present to attempt to prove that retinal lesions occur exclusively in any one type of toxæmia of pregnancy. . . . From the purely clinical standpoint, though it is evident that permanent arterio sclerosis remains as a residue in most cases of diffuse retinitis of toxæmia of pregnancy, it is also true that in some

cases, especially when the retinitis is localised rather than diffuse, any permanent arterio sclerosis is so slight as to be clinically negligible. It seems possible, therefore, that mild retinitis can develop in the vaso spastic stage of the toxæmia before organic changes occur of sufficient degree to be irreparable. In most cases of severe diffuse retinitis, however, definite organic vascular changes are the inevitable residue."

Apart from spasm of the arterioles, swelling of the disc is, according to Grace Jones, the first stage to be observed in the majority of cases. "The disc is swollen, has indistinct margins and is most often reddened. The swelling is largely due to œdema, and is nearly always accompanied by swelling of the adjacent parts of the retina. The whole fundus therefore tends to have a steamy or hazy appearance." The œdema and blurring of the disc is liable to be associated with increased pressure in the spinal fluid. Detachment of the retina from accumulation of subretinal fluid in severe œdema is a very rare complication. The prognosis is good, and usually the retina becomes reattached in a month or less (Doggart, Hallum).

The subjective signs in these cases are few, and a very advanced retinitis may be present without complaint being made. 'The most common symptoms are spots in front of the eyes, flashes of light, dimness of vision, distortion of images and occasionally discomfort, but rarely pain' (Grace Jones).

As to the incidence of the various lesions, in 124 cases of pre eclamptic toxæmia investigated by Grace Jones 69 showed no change, 43 showed œdema of the disc and retina, 5 showed individual cotton wool patches of exudate and hæmorrhagic areas in the retina, and 7 diffuse retinitis of the albuminuric type. Of 19 cases of eclampsia 5 showed no change, 8 showed œdema of the retina and disc, and 6 showed individual cotton wool patches of exudate and hæmorrhagic areas.

It is evident, therefore, that examination of the fundus at frequent intervals should be an important part of the routine care of cases of toxæmia of pregnancy of all types, even when there are no visual disturbances, and especially if the blood pressure is rising rapidly. If cotton wool patches and hæmorrhages appear, or detachment of the retina, pregnancy should be terminated without delay. This is all the more necessary as there is reason to believe that the degree of involvement of the retinal arterioles can be taken as an indication of the condition of the systemic arterioles,

and to them delay means the development of definite sclerotic changes. We shall see (p 344) that this is a frequent later sequel of pre eclamptic toxæmia.

It is interesting to note that retinal hæmorrhages and exudate may completely clear up after delivery and leave no trace. We have seen this happen on three occasions.

Abnormal Increase in Weight as an Early Sign of Pre-eclamptic Toxæmia. In pregnancy there is normally a considerable gain in weight especially during the last six months due to the fœtus, placenta, liquor amni, increase in size of the uterus and of the blood volume and often to the laying down of fat in the mother's own tissues. Cummings in 1 000 women found that the total average gain was 24.08 pounds, the average monthly weight changes being 0 1 1 4 4 5 5 3 3 pounds (Table V III). About 40 per cent showed a loss of from 1 to 3 pounds in the two weeks preceding labour.

In addition to these normal gains there may be increases due to latent or pre clinical œdema caused by fluid retention that we have already seen (p 311) was considered by Zangemeister to be the earliest demonstrable event in pre eclamptic toxæmia. In this section we have to consider how far his contentions have been supported by later observations. Cummings whose large scale investigation has been referred to above says "by observing the weight changes at frequent intervals during the last two months of pregnancy some very definite opinions have been formed. One is often surprised when a patient who has averaged an increase of a pound each week suddenly gains from 5 to 10 pounds in a two week period. Her food has not been changed or increased. She may state that her hands feel stiff or that her rings seem tight. No definite œdema is demonstrable but the skin feels unusually firm. A few weeks later increase in blood pressure is discovered and albumin and œdema appear. This sudden gain in weight can only be explained by fluid retention in the tissues of the body and if this tendency towards storing fluids is not checked the physician is faced by a threatened toxæmia. Weight recordings give warning of this potential danger before urinalysis or blood pressure readings herald the impending syndrome. It is true that not all of these patients develop toxæmias but the possibility is so great that one should give heed to any sudden weight increase. Among the 1 000 women there were 131 that gained over 20 pounds. Sixty three of these showed signs of toxæmia

or actually developed it, they constituted 48 per cent of the over-weight patients

Siddall and Mack, in a very critical paper dealing with 663 patients, of whom 624 were normal and 39 toxæmic, give the results of weighings at the 24th, 28th, 32nd, 34th, 36th, 38th and

TABLE VIII *Average Normal Weight Changes in Pregnancy*
(Cummings) (1,000 Women)

Month	Pounds		Kilograms	
Normal Weight	120 10		58 68	
First	129 12		58 69	
Second	128 04		58 20	
Third	129 35		58 88	
Gain during first trimester		0 45		0 2
Fourth	133 11		60 50	
Fifth	137 71		62 60	
Sixth	142 08		64 85	
Gain during second trimester		13 13		5 96
Seventh	147 72		67 14	
Eighth	150 08		68 62	
Ninth	153 18		69 17	
Gain during third trimester		10 50		4 77
Total average gain during pregnancy		24 08		10 94

40th weeks They found that the average weight gains in the normal patients were as shown in Table IX The variations were, however, extremely wide These are shown in the third column of the same table

As will be seen from Table X, the weight gains were greatest in young patients, but parity made little difference Amongst the 39 toxæmic patients the total average gain was 20 9 pounds compared with 15 7 pounds in normal women Taking for practical purposes an excessive gain to be twice the normal average at each period according to age (Table IX), they found that 72 per cent of the toxæmic patients gained excessively at one or more periods The excessive gain was noted before the first definite sign of toxæmia (usually hypertension) in 43 7 per cent of the cases, at the same time as the first definite sign in 15 7 per cent and after it in 12 8 per cent Twenty eight per cent. of the toxæmic group showed no excessive gain There were four cases of eclampsia, each of which gained excessively at one or more periods in the last four months In two cases the excessive gain preceded, and in two coincided with, the appearance of the first sign of toxæmia

These findings suggested that regular weighing might be of value in anticipating a considerable proportion of toxæmic cases

TABLE IX *Average Gain in Weight at various Periods of Pregnancy in Normal (Non toxæmic) Women Compiled from figures of Siddall and Mack*

Weeks	Average gain in lbs	Variations
24—28	4.4	From a loss of weight to over 10 lbs +
28—32	3.9	Ditto
32—34	2.0	Ditto
34—36	2.1	From a loss of weight to over 8 lbs +
36—38	2.0	From a loss of weight to over 10 lbs +
38—40	1.3	Ditto
	15.7	

since in more than two fifths there was an excessive gain preceding definite signs of the disease. This however, was found not to be

TABLE X *Average Periodic Weight Gains according to Parity and Age (Siddall and Mack)*

Weeks	24—28	28—32	32—34	34—36	36—38	38—40	Total.
Age							
Para 1							
—25 yrs	5.1	4.6	2.2	2.4	2.3	1.1	17.7
25—35	4.3	3.9	2.0	2.3	2.2	1.3	16.0
35—	3.3	3.9	2.3	1.3	1.2	1.0	12.3
Para 2							
—25 yrs	5.6	4.3	1.9	1.9	2.1	3.3	19.1
25—35	4.5	4.0	2.0	2.1	1.7	1.2	15.5
35—	3.4	3.3	2.4	1.7	2.1	0.9	13.8
Para 3							
—25 yrs	—	—	—	—	—	—	—
25—35	4.7	3.6	1.8	1.8	1.8	1.9	15.6
35—	2.7	2.7	1.5	1.6	1.6	0.8	10.9
Whole group							
—25 yrs	5.2	4.4	2.1	2.3	2.3	1.4	17.8
25—35	4.4	3.9	1.9	2.1	1.9	1.4	15.7
35—	3.1	3.1	2.0	1.5	1.6	0.9	12.2

the case for in the complete series there was the large group of 280 women with a similar gain of at least twice the average in one or more periods who completed pregnancy without any sign of toxæmia. Combining the figures there was a group of 29~

available for the prediction, if possible, of toxæmia on the basis of excessive weight gain. Actually only 1 in 17 developed toxæmia—essentially the same incidence as for the whole series of 663 patients. Siddall and Mack therefore conclude that excessive weight gain is "of questionable clinical value in the early recognition of impending toxæmia."

Arwyn Evans, on the other hand, after observation of a series of 211 women, 52 of whom developed toxæmia, concluded that a sudden abnormal increase in weight is of great value in foretelling toxæmia, for 63 per cent of all the women that gained more than 8 pounds in one month became toxæmic, while the incidence of toxæmia in those women with a normal monthly gain was only 0.9 per cent. The abnormal gain in weight was the first sign of toxæmia in 65.3 per cent of the 52 cases, and appeared on an average one month before albuminuria, and, as a rule, also before the hypertension. An increase of 5 pounds or more per month he considers suggestive of impending toxæmia. All patients, however, that showed such a high increase did not develop toxæmia.

On the whole therefore, provided too much is not expected from it, a case appears to have been made out for routine weight taking in pregnancy, and it would seem that we are justified in drawing the following conclusions:

(1) An increase of over 5 pounds in weight in any one month during pregnancy should be a warning of the possible onset of toxæmia, and a signal for more frequent examinations and for putting the patient on a salt free diet with limitation of fluid.

(2) All patients who show an increase of 5 pounds or over do not develop toxæmia even if left untreated. Only 50 per cent of patients in Arwyn Evans' series who showed an increase of 5 pounds or over in any one month subsequently developed pre-eclamptic toxæmia.

(3) Pre-eclamptic toxæmia may set in without any preceding warning in the way of abnormal increase in weight.

The following case in which abnormal weight increases provided the only warning sign of the subsequent apparently sudden development of eclampsia is of great interest in this connection.

Mrs. D., a primigravida, aged twenty five, previously healthy, was first seen at the Antenatal Clinic on 23/11/39 L.M.P. June 12th. Expected date of delivery, March 19th, 1940. She

attended the clinic six times when the following records were made —

Date	R P	Alb	Weight	Edema.
23 11/39	105/75	nil	8 4	nil
21 12 39	110/65	nil	8 11½	nil
16 1 40	110/80	nil	9 0½	nil
13 2/40	120/80	nil	9 9	nil
27/2 40	120/80	nil	10 0	Slight of ankles and hands
5 3 40	138/92	nil	10 0½	nil

It will be seen that there was only a slight rise of blood pressure on one occasion viz at her last visit and that there had been no albuminuria at any time. There had however been an abnormal increase of weight on three occasions i.e. at the second fourth and fifth visits of 7½ lbs 8½ lbs and 5 lbs respectively. She was to return on 12/3/40 but was admitted at noon on that day having had three eclamptic fits. The only abnormal symptoms had been headache at 5 a.m. on the day of admission. Had weight records not been available this patient might well have been quoted as an illustration of the onset of eclampsia like lightning out of a clear sky.

The Cold Test in Pregnancy This was introduced by Hines and Brown in 1933. They hoped that by its use it would be possible to pick out those individuals who had a constitutional predisposition to hypertension. The test is carried out as follows. The person to be tested is kept lying down for twenty minutes or more the blood pressure being recorded every five minutes until it has reached a basal level. The opposite hand is then placed in a bath of ice water at 4° or 5°C for two minutes and the systolic pressure is recorded every thirty seconds during that time. The hand is then removed from the bath and dried and the pressure recorded every two minutes till it returns to the base level. Three measurements were regarded as important viz the peak or ceiling (the highest pressure observed while the hand is in the bath) the range (the difference between the peak and the basal pressure) and finally the time elapsing till the pressure returns to the base level. The highest normal peak is placed at

115 mm Hg, the highest normal range has been variously placed at 20-22 or 30 mm while the time taken to return to normal should not be more than two minutes. As Hines and Brown carried out their tests on patients who were not pregnant it was impossible to say whether hyper reactors would ultimately develop clinical hypertension without following them up for a long period of years which has not yet been done. In pregnancy however onset of the hypertensive type of pre eclamptic toxæmia only takes a few months and it has therefore been thought possible to pick out early in pregnancy those women who because of a constitutional predisposition would later develop this disorder. Dieckmann used the test in 152 normal pregnant women. Regarding a range of 30 mm or more as abnormal he found that 90 patients were hyper reactors and of these 31.1 per cent developed toxæmia while of the 62 patients who gave a normal reaction only 11.3 per cent did so. Browne used the test in fifty-two normal primigravidae and reached the following conclusions: a peak of 150 or over is a fairly good but not invariable indication that hypertensive toxæmia will develop later. Neither the range nor the time taken to return to the base level seemed to be of any value. A high basal pressure however did seem to be of value for the mean basal pressure among the patients who developed toxæmia was 116 while amongst those who did not develop toxæmia it was only 109, a difference that was statistically significant. Each test takes almost half an hour to carry out and it is therefore not suitable for use in a busy clinic though it might have a place in private practice. It does not seem however to be of sufficient value to make it worth while.

The Eclamptic Convulsion This is practically always preceded by the signs and symptoms of pre eclamptic toxæmia above described. Especially important as signs of impending convulsions are headache, giddiness, visual disturbances (dimness of sight, diplopia, flashes of light or complete blindness), vomiting, epigastric pain (possibly due to liver necrosis) and perhaps most important of all a sudden rise of blood pressure especially over 160. This is particularly dangerous if accompanied by much œdema. Four stages of the convulsion are described.

(1) *The Premonitory Stage* The patient rolls her eyes and there are twitchings of the face and hands. It lasts about half a minute.

(2) *The Tonic Stage* The patient is rigid and the face distorted, the eyes protrude, the hands are clenched and the entire

frequent cause of death is heart failure, which is explained partly by the degeneration of the heart muscle, partly by the increased peripheral resistance consequent on the hypertension the hypostatic congestion of the lungs, and the rapidly recurring convulsions

Biochemical Changes in Pre-eclamptic Toxaemia and Eclampsia

Though much careful work has been done little has been found that elucidates the aetiology or helps in early diagnosis or treatment. The following is a summary of the most important findings

Uric Acid The blood uric acid in the pregnant and non-pregnant woman is about the same *i.e.* about 2.5 to 4.5 mg per 100 c.c. In pre-eclamptic toxaemia and eclampsia it is usually increased, and this increase is according to Cadden and Stander (1939) the earliest perversion of metabolism so far noted in these conditions. In 132 cases of eclampsia these observers found that the blood uric acid averaged 6.3 mg per 100 c.c. and in one case in which the liver was severely damaged it reached 12.2 per cent. The excretion of uric acid in the urine is unchanged and it is believed that its increase in the blood is due to diminished destruction by the damaged liver in which normally about 80 per cent. of the uric acid is destroyed

Blood Non-protein Nitrogen and Urea Nitrogen Both these substances are considerably less in the pregnant than in the non-pregnant woman the non-protein nitrogen being reduced from 30 to 24 mg per 100 c.c. and the blood urea from 14 to 6. In pre-eclamptic toxaemia and eclampsia they may both be normal but in severe cases, where there is damaged renal function they may be considerably raised the increase being due to retention by the diseased kidneys

Fibrinogen The fibrinogen nitrogen is increased in normal pregnancy. In the non-pregnant woman de Wesselow found the average value to be 40 mg per 100 c.c. of blood and in pregnant women 76. In severe pre-eclamptic toxaemia and eclampsia it averaged 101, but the significance of this increase is not known

Lactic Acid This is little changed in normal pregnancy, but in eclampsia, especially after a fit, it may be much increased—as much as 200 per cent. (Stander and Radelet). The increase is not due to muscular activity, as it is absent in epileptic attacks in pregnancy

Acid-Base Equilibrium Even in normal pregnancy carbohydrate metabolism is profoundly disturbed and there is a

repeated examinations of the urine before and between the fits failed to show the presence of albumin. Desser has reported a case in which the blood pressure during pregnancy had been normal and on the day before the outbreak of eclampsia was 122/85, but there was a trace of albumin and some œdema of the face, and the weight had increased by 8 pounds in the previous fortnight. The statement is often made that there is a small percentage of cases in which eclampsia cannot be foreseen or prevented. For my own part I can only say that I have never seen such a case, and careful scanning of our records shows that in every patient in whom eclampsia developed there were one or more warning signs—rise of blood pressure, albuminuria, œdema or abnormal weight increase, which, had their significance been appreciated, should have led to the immediate institution of prophylactic treatment. Details of one such case have been given above (p. 337). In no department of antenatal care are constant watchfulness and prompt action more necessary than in the prevention of eclampsia.

Investigation of a Case of Albuminuria in Pregnancy. Albumin in the urine of a pregnant woman may be due to many other causes than pre-eclamptic toxæmia. If albumin is found, therefore, proceed as follows.

(1) Take a catheter specimen to exclude contamination of urine by vaginal discharge.

(2) Estimate blood pressure. If this is below 180/70 it is almost certain that the albumin is not due to pre-eclamptic toxæmia.

(3) Examine the urine for casts after centrifuging. If the albuminuria is of toxic origin it usually contains casts—hyaline, epithelial and granular. These may, however, be absent in toxic albuminuria. A few red blood cells are often present, and are additional evidence.

(4) Examine the urine for pus and organisms, as the albumin may be due to pyelitis. This is best done by the microscope as described under pyelitis (p. 484).

(5) Look for other signs and symptoms of toxæmia, e.g., œdema, headache, etc.

(6) Try to determine whether the case is one of nephritic toxæmia (p. 337).

(7) Severe anæmia may cause albuminuria, but other signs of toxæmia are usually absent. A blood count should be done if there is doubt.

level, and if albumin is not already present when treatment is started it rarely appears afterwards. If, however, albumin is already present it usually persists, without increasing, until delivery and for a variable time after. The danger of deterioration increases as pregnancy proceeds and these cases should be kept under strict supervision till delivered. There would seem to be a special danger of eclampsia in the second stage of labour, possibly on account of the rapid rise of blood pressure at that time. In University College Hospital the fetal and neo natal mortality in pre eclamptic toxæmia over the twelve year period 1927 to 1938 was 13 per cent.

Remote Schroeder (1878) seems to have been the first to draw attention to the danger of the development of chronic glomerular nephritis as a late result of pre eclamptic toxæmia and eclampsia and within recent years his views have been supported and amplified by numerous writers, such as Slemons (1913), Harris (1924) Gibberd (1928) Young (1929), Sym (1929), etc. It was generally believed that chronic nephritis followed pre eclamptic toxæmia in about 50 per cent of cases, and eclampsia in about 30 per cent. During the last ten years, however, increasing emphasis has been laid on vascular injury as the residual lesion in these disorders and we now believe that chronic nephritis following them is exceedingly rare, if it ever occurs at all. For these newer views we are chiefly indebted to American and German writers amongst whom may be mentioned Corwin and Herrick (1927) Kobes (1930) Schultz (1933) Hevemann (1934) and Herrick and Tillman (1935). Kobes, in a follow up of 51 women (32 eclamptics and 19 pre eclamptics) found only one case in which there appeared to be residual chronic nephritis. Schultz says that "healing of the kidney lesion after eclampsia and pre eclampsia is the rule" and that chronic nephritis is an exceedingly rare sequel if it occurs at all. He contends that the writers who claim that chronic nephritis is a sequel of eclampsia and pre eclamptic toxæmia have not been able to bring any evidence in support of it from anatomical kidney preparations.

In November, 1926, a clinic was started in the obstetric unit University College Hospital for the follow up of patients who had suffered from the toxæmias of late pregnancy and the results have recently been analysed by Gladys H. Dodds and the author. In all, 400 women have been studied in 589 pregnancies, the period of follow up varying from twelve years to six months. The cases

ultimately well, the illness prior to delivery had lasted eight weeks while in some of those that developed chronic hypertension the illness had lasted only one or two weeks. At the same time the duration of the illness is the one factor over which we have control and for practical purposes it is therefore necessary to remember that, other things being equal, the longer the duration of the illness prior to delivery, the greater is the ultimate risk to the patient's health. Most observers are agreed that if the illness lasts more than four weeks the risk of permanent injury is very great and that if pre eclamptic toxæmia has lasted four weeks, the pregnancy should be terminated. Our own results do not lead us to disagree with this rule, provided it is not adhered to too rigidly, and it is remembered that the duration of illness must be considered in relation to the other factors above mentioned.

It is noteworthy that the height of the blood pressure on discharge from hospital gives little guidance to the ultimate prognosis. A patient who has had a normal B P on discharge may return six months later with hypertension and one who has hypertension on discharge may be found six months later to be healthy. Thus 76.8 per cent of our patients who developed a residual hypertension had a normal B P on discharge and 13.2 per cent of those who ultimately became well had hypertension on discharge. The large proportion of ultimately hypertensive patients in our series who had normal B P on discharge is very striking, and is probably due to the fact that they are at rest and free from domestic worries. For practical purposes the important point to notice is that these patients must be followed up for at least six months after delivery before it is possible to determine whether or not they have sustained permanent vascular injury.

Recurrent Toxæmia This may be defined as the occurrence of toxæmia in two or more successive pregnancies, the patient being apparently healthy between. Two views have been expressed regarding the cause and significance of this recurrence. (1) Kellogg (1924) suggested that it was due to a "concealed nephritis" that gave rise to no signs or symptoms when the patient was not pregnant but which, when the "load of pregnancy" was superadded, caused her to develop manifest kidney insufficiency. Gibberd (1928) adopted this explanation and expressed the opinion that pregnancy was the best test of kidney function since "an amount of structural damage, insufficient to give rise

to signs or symptoms might yet make itself felt during pregnancy." In 1929 he introduced the term "occult nephritis" to describe the "concealed nephritis" of Kellogg. (2) Young (1929) stated his belief that the recurrence was due to some unknown factor which, during pregnancy, involved the life of the placenta and hence gave rise to abortion, accidental hæmorrhage or toxæmia, the last only occurring if the area of placenta damaged or separated was large enough, and the placenta retained for a sufficiently long time.

In our series we found that 60 per cent of the patients who developed recurrent toxæmia had a hypertension of over 120/70 between the toxæmic pregnancies. In other words the patients, though they seemed well, had a persistent hypertension after the first pregnancy, which in the next became aggravated, often with the reappearance of albuminuria and œdema, and not infrequently ending in abortion or miscarriage. In the remaining 40 per cent the blood pressure, though normal, was borderline, with an instability that in the succeeding pregnancy probably predisposed to the recurrence of hypertensive toxæmia. We believe that in these cases there is a familial hypertensive tendency, and that pregnancy does nothing more than unmask a latent hypertension that in the absence of pregnancy would have developed in any case, though probably at a somewhat later period. Furthermore, we see no reason to believe that this borderline hypertension and instability of blood pressure, which is in our opinion an important cause of recurrent toxæmia, is a result of the previous pre-eclamptic toxæmia. It is probable that it existed before the first pre-eclamptic toxæmia and predisposed to it. This view, too, would explain the findings of G. W. Theobald. This author in a remarkable paper published in 1933 produced figures from the Registrar General's Decennial Report for England and Wales for the ten year period 1911 to 1920 which, in his opinion, threw considerable doubt on the accuracy of the view that pregnancy toxæmia could cause chronic nephritis or even disease of the circulatory system. The figures in the Report showed that during these years the mortality curves from Bright's disease, including hypertensive cardiovascular diseases, followed the same upward and downward trends as those for men, and that there was no significant difference between the mortality rates from these diseases for married and single women up to the age of 55. Theobald's contentions have never been adequately answered and must be taken as correct.

A little consideration will show that if it is accepted that

manifest chronic nephritis does not occur as a sequel of pre-eclamptic toxæmia and eclampsia, then "occult or concealed nephritis" does not occur either. "Occult nephritis" is only a mild form of manifest chronic nephritis, in other words, the difference between the two would be nothing more than one of degree, and if the milder degrees occur the more serious degrees with persistent albuminuria must occur also and probably as often. If occult nephritis following pre-eclamptic toxæmia or eclampsia is the explanation of recurrent toxæmia which is a frequent phenomenon in obstetric practice then manifest nephritis with albuminuria should be commonly found as a sequel of these disorders which it is not.

Prognosis of Eclampsia (1) *Immediate* Eclampsia ranks second (next to puerperal sepsis) as a cause of maternal mortality in England and Wales. Of 4 655 cases of maternal death investigated by the Departmental Committee on Maternal Mortality and Morbidity 544 were due to eclampsia (11·3 per cent). Eden commenting in 1922 on the 2 005 cases of eclampsia reported from various parts of Great Britain found that the mean death rate was 22·5 per cent. In the London area it was 21·9 per cent, in Edinburgh 25 per cent, in Dublin 10·29 per cent, in the North of England 24·53 per cent, and in the Midlands 25·10 per cent. The following phenomena were considered to be signs of danger: Coma between fits, a pulse over 120, a temperature over 103°, a number of fits greater than ten (patients who have had 200 fits however, have been known to recover—Jardine), urine that becomes solid on boiling, the absence of œdema and a blood pressure over 200. If a patient exhibits any two of these danger signs the case should be classed as "severe". The time of onset of fits, too, seems to have an important bearing on prognosis. When the fits started before labour the maternal mortality was 20·5 per cent., when they set in during labour it was 16·6 per cent., and if they began after delivery it was 27·6 per cent. The mortality is considerably influenced by the treatment adopted, the best results being obtained by the expectant method with a minimum of operative interference. The elaboration of this method was largely due to the Dublin school, and to Stroganoff, who introduced his "prophylactic" method in 1897, and in 1929 was able to collect nearly 6,000 cases treated by means of it in various countries with a mortality of 10·4 per cent. In his own clinic the mortality had been previously 22 per cent. Solomons, in 1922, reported 200 cases

treated by the Dublin method with a mortality of 10·2 per cent. We have already seen (p 13) that in spite of antenatal care the death rate from eclampsia, and presumably the incidence of the disease has diminished little in the last twenty years. Yet eclampsia is almost entirely a preventable disease, and there can be little doubt that with earlier diagnosis, and earlier and more adequate treatment of pre eclamptic toxæmia together with the more general and rigid application of the expectant method in the treatment of eclampsia when it arises, the incidence of, and the mortality from, the disease can be much reduced. "I have at present," says Stroganoff "formed the belief that eclampsia is absolutely curable if the improved prophylactic method is properly applied providing the patient does not enter the hospital in a hopeless condition, and does not develop any fatal diseases complicating the condition."

It is generally agreed that women who have had eclampsia or pre eclamptic toxæmia have an increased liability to puerperal sepsis. Kellogg from a study of 400 cases claimed that toxæmic patients were about four times as likely as normal patients to develop puerperal sepsis under similar methods of delivery. This may be due to lowered resistance and perhaps also to contamination by faecal material after violent purgation.

The foetal mortality in eclampsia is very high. In our own series of 48 cases it was 48 per cent, including neo natal deaths. Others have however, reported better results. 30·2 per cent in 299 cases (Reese and Peyton), 23·92 per cent in 105 cases (Ware and Noblin), 39·3 per cent in 61 cases (Lennon). The high mortality is due partly to the fact that labour so often comes on prematurely, partly to the lethal influence of the toxæmia or the convulsions on the foetus. The same remarks regarding its reduction apply as in the case of the mother.

Remote. The incidence of residual chronic hypertension in our cases was 70 per cent. We do not find any support for the view first stated by Harris in 1924, and since then commonly held that, as regards residual damage, eclampsia is less serious than pre eclamptic toxæmia. Chronic nephritis was not found as a residual lesion in any of our cases. The same factors as in pre eclamptic toxæmia seem to influence the remote prognosis and with the same reservations (p 346). As in pre eclamptic toxæmia, blood pressure on discharge is an unreliable guide to ultimate prognosis and before this can be determined it is necessary

to follow the patient up for at least six months after delivery. It is noteworthy that one of our eclamptic patients had retinal hæmorrhages in both eyes which subsequently cleared up completely. She passed through another hypertensive pregnancy three years after the eclampsia and gave birth to a live child at term. During this pregnancy the hæmorrhages did not reappear.

Risk of Recurrence of Eclampsia in Succeeding Pregnancies A patient who has once had eclampsia is much more liable to have it again in subsequent pregnancies but only if chronic hypertension has succeeded the eclamptic pregnancy. Hinselmann from a survey of 10 000 cases of eclampsia collected from the literature concluded that it recurred in 1.92 per cent. of subsequent pregnancies. Therefore, if we accept the incidence of eclampsia as 1 in 500 pregnancies eclampsia is about ten times as frequent in those who have had a previous attack. Schmechel however found a far higher recurrence rate. Of his own series of 238 cases of eclampsia 83 became pregnant again and eclampsia recurred in 15 (18 per cent.). Clow reports a case in which eclamptic convulsions occurred in four successive pregnancies and Laun one in which it recurred three times. The woman had been pregnant six times. The 1st pregnancy and labour were said to be normal the 2nd ended in abortion the 5th in intra uterine death at the 6th month while the 3rd 4th and 6th pregnancies were complicated by eclampsia.

Treatment of Pre-eclamptic Toxæmia *General principles* Believing, as we do, that œdema and high blood pressure are the two factors in pre eclamptic toxæmia that if allowed to develop sufficiently may ultimately lead to eclampsia treatment is directed to the control of both. In absence of exact knowledge regarding its causes œdema is treated by saline purgatives, sudorifics and limitation of fluid and salt. For the control of hypertension rest is at present the chief agent available. The low protein diet is given because it is supposed to lessen the strain on the kidneys and because poisoning by protein derivatives was believed to play a part in the causation of eclampsia. In all cases and especially in view of the possibility that deficiency of these substances plays an important part in ætiology an adequate supply of vitamins and minerals must be ensured—all the more necessary as patients with pre eclamptic toxæmia are often under treatment for a long time. Finally, as high blood pressure if too long continued may lead to organic changes in the vascular

system and thus to permanent hypertension the question of premature termination of pregnancy must be considered. Based upon these considerations the following is the routine treatment carried out in the Obstetric Unit, University College Hospital.

All patients with blood pressure 150/100 or over to be admitted to hospital. They should also be admitted if the B.P. is above 130/90 and there is at the same time oedema, abnormal gain in weight or albuminuria.

(1) *Mild Cases* Blood pressure raised but under 150/100 and no oedema, albuminuria or abnormal gain in weight. Treat as outdoor patients. Rest as much as possible—not necessarily in bed. Cut out butcher meat, increase carbohydrates, give plenty of vegetables, fruit, salads and 1 pint or more of milk daily. Restrict fluid and salt and give saline purgatives. Order Bemax or Marmite daily and two capsules daily of halibut liver oil. In all cases examine again in one week.

(2) *Severe Cases* Blood pressure 150/100 or over with or without oedema or albuminuria or above 130/90 if there is oedema, abnormal increase in weight or albuminuria. Rest in bed, cut out red meat, plenty of vegetables, fruit and green stuff, 1 pint or more of milk daily, salt free diet and restrict fluids to quantity of urine passed but not less than 1 pint daily, including that taken as milk, tea or coffee, increase carbohydrates (glucose etc.). Give Bemax or Marmite to ensure sufficiency of vitamin B and halibut liver oil to supply vitamins A and D. Purgation (jalap, salines), ultra violet light may reduce blood pressure. Hot bottles, blankets, fire in room to encourage sweating. Record blood pressure and quantity of urine daily and estimate albumin in catheter specimen once weekly. Examine fundus oculi once or twice weekly.

If the blood pressure does not become normal after a reasonable trial of the above treatment termination of pregnancy must be considered because it is known that if the high blood pressure is long continued organic changes may occur in the vascular system leading to chronic hypertension. How long termination should be delayed will depend on the severity of the hypertension, the length of time it has persisted and the period the pregnancy has reached. Each case must be judged on its merits. If possible it is well to allow pregnancy to continue until the child is viable that is till the end of the 36th week counted from the first day of the last period but it is sometimes undesirable to wait so long—if

the blood pressure is very high, say 160 or over and remains so in spite of treatment. In making the decision the general rule should be borne in mind, that if the hypertension has persisted for 4 weeks or over the chances of chronic hypertension developing are very great, and the more this time can be reduced the better for the mother. It should be remembered too that termination is also often best for the child as there is a great risk of its death *in utero* if the blood pressure continues high, certainly if it is over 160 and especially if there is albuminuria. An urgent and absolute indication for termination, usually by Cæsarean section, is albuminuric retinitis or retinal hæmorrhages, but the disease should never be allowed to progress so far. If pregnancy is likely to terminate prematurely as it is in all cases of serious pre-eclamptic toxæmia, or if it is to be terminated artificially, vitamin K should be administered to the mother beforehand (p. 65).

(3) *Pre eclamptic State* (all the above signs more marked, also headaches, visual disturbances, vomiting, epigastric pain) Complete starvation. Glucose water only by mouth, hot bottles, blankets, brisk purgation, venesection to 10-20 oz (if blood pressure above 170 mm.), ultra violet light, etc. If there is not rapid and marked improvement in a day or two, pregnancy must be terminated. In urgent cases, Cæsarean section is best. If less urgent, induction by puncture of membranes or hind waters (p. 283).

Little comment is necessary on this summary. Rest in bed, which must be absolute, is by far the most potent remedy for high blood pressure. A low protein diet (cutting out meat, especially red meat, soups and meat extracts, eggs, cured fish, bacon, pork, beans, peas, lentils) is helpful but of less importance. Harding and van Wyck did not find a high protein diet injurious provided a minimal amount of salt was given. Indeed, the observations of Strauss, already referred to (p. 312), suggest that it may diminish œdema. As these patients tend to be anæmic it is well to estimate the hæmoglobin at the beginning of treatment, and at monthly intervals thereafter, and to give Blaud's pills thrice daily if it is much below 90 per cent. The salt free diet is called for in all cases, for salt tends to cause water retention, and to diminish the output of urine. It is, of course, impossible to get an absolutely salt free diet, for raw materials such as milk contain it. A moderately strict salt free diet is all that is usually necessary, and this can be ensured by adding no salt in cooking or during meals. If a more strict salt free

diet is wanted bread that has been baked without the addition of salt can be used. To get over the difficulty of the tastelessness of the food *selaarom* (Bayer) can be used instead of salt, or if this is not available onion lemon juice, pepper, vinegar, mustard, etc., will help. They increase its palatability—and do not, as is commonly supposed irritate the kidneys. The best index of the patient's progress is the behaviour of the blood pressure, and this should be watched carefully from day to day. If it does not fall, and still more if it is rising the response to treatment is not satisfactory. Another very important indication of progress is the amount of albumin in the urine. If this is increasing it shows that the condition of the patient is deteriorating and, no matter how the blood pressure is behaving, that there is danger of eclampsia and the fœtus in urgent danger of perishing.

Treatment of Eclampsia The following is the scheme of treatment carried out in University College Hospital. It is in all its essentials a combination of the Stroganoff and the Dublin methods. Almost the only difference is the use of paraldehyde in place of chloral hydrate, which we consider to be too much of a cardiac depressant. We do not like to repeat the morphia as often as Stroganoff advised. Calcium is given to protect the liver.

TREATMENT TO BE PERFORMED IN CASES OF ECLAMPSIA

Stroganoff's View as to the Danger of Eclampsia

(a) The danger of eclampsia is largely in proportion to the number of fits.

(b) Extraneous stimuli (tactile, auditory, visual) have very great importance in the causation of fits.

(c) If such extraneous stimuli can be prevented or nearly prevented then fits will not occur and the patient will usually recover.

A General (1) Patient on labour bed in semi prone position. Position to be changed from left to right and right to left every two hours to avoid hypostatic pneumonia.

(2) If unconscious, the head should be so placed that saliva can dribble away, and a rubber wedge should be in readiness for use in every case. Mucus to be wiped from nose and mouth.

(3) Room to be darkened and all noise prevented.

(4) During a fit a rubber wedge or other suitable apparatus is

to be placed between the teeth. Oxygen to be administered after the fit till cyanosis has disappeared.

(5) Any disturbance of the patient—*e.g.*, passing catheter, vaginal examination, injection of morphia, etc.—must be carried out under chloroform.

(6) If conscious, glucose water only by mouth.

(7) Sweating encouraged by warm, light blankets and warm room, hot bottles (carefully guarded), especially to feet and kidneys.

(8) A nurse should be in constant attendance, at least until fits are controlled. She should wear noiseless slippers.

B Routine Medical (1) If patient has recently had a heavy meal, wash out stomach under chloroform using repeated washings of sodium bicarbonate solution 1 drachm to the pint, until the return is clear.

(2) Introduce into the stomach *via* the stomach tube a saturated solution of magnesium sulphate, 2 oz. This should only be done if the stomach has been washed out.

(3) Pass soft high rectal tube, 1½ feet long under chloroform, and wash out lower bowel until the return is clear. (This will take a long time and will require up to 4 gallons of sodium bicarbonate solution.)

(4) When rectal wash out is complete introduce paraldehyde, 6 drachms, in olive oil. Repeat paraldehyde in four hours and again in six hours.

C Special Medical (1) If restless morphine tartrate gr ½, and atropine gr 1/150. This must be done under chloroform.

(2) If cyanosed or blood pressure 170 mm, venesection under chloroform, 10 to 20 fluid oz.

(3) Calcium gluconate, 10 c.c. of a 10 per cent solution to be given intravenously daily if unconscious. If conscious calcium lactate 15 grains thrice daily by mouth.

D Obstetric Nil, except (1) If os half dilated the membranes may be ruptured.

(2) If cervix fully dilated and the head well down forceps extraction may be employed.

(3) If fulminating type of eclampsia with an undilated cervix particularly if the child is alive, or

If the fits are not controlled despite the above treatment, and providing that no other method of rapid delivery is practicable Cæsarean section may be done.

(4) If indicated by some other obstetric complication the appropriate obstetric interference is to be adopted

(5) If labour has not started it must be induced within three or four days after fits are controlled unless the foetus has died. The best method is usually rupture of the membranes

Treatment [of Eclampsia by Magnesium Sulphate] Stroganoff and Davidovitch have recently reported favourable results from treatment of eclampsia with magnesium sulphate, which apparently increases diuresis diminishes œdema causes a fall in blood pressure and controls the fits. In 201 cases treated the mortality was 6 (3 per cent) and in 176 of them (67 per cent) the convulsions ceased after the first dose. The details are as follows. The patient is nursed in a quiet semi-darkened room with constant observation by a trained nurse. Measures are taken to avoid anything that might disturb or irritate her. In a short time following the fit, or on being admitted to hospital she is given an injection of 0.015 to 0.02 grams of morphine muriate under light chloroform anæsthesia and is examined. In 30 minutes about 6.0 grams of MgSO_4 are given subcutaneously (40 grams of a 15 per cent solution). 1½ hours later morphine is injected and after an interval of 3½ hours (5½ hours after the start of the treatment) 6.0 grams MgSO_4 are given if there has been another fit, or 4.0 grams if there has been none. If delivery does not occur 4.0 grams or 3.0 grams MgSO_4 are administered after a further interval of 6 hours and then of 8 hours respectively (i.e. 11½ hours and 19 hours after commencement of the treatment). If the fits do not cease the patient is given the full dose i.e. 6.0 grams MgSO_4 but no more than 24.0 grams in 24 hours. Venesection was performed and the membranes ruptured in each of those cases in which the patient was admitted after having had six fits or even fewer if they had been very severe. It is of the greatest importance to keep the patient warm and preferably on her right side as well as to administer oxygen following a fit and to ensure that the room is well ventilated.

In some cases the injections cause serious toxic effects which may prove fatal—acute cyanosis feeble pulse and laboured breathing—so that an antidote should always be ready at hand. The best is 10 grams of a 5 per cent solution of calcium chloride injected intravenously. Another disadvantage is the occasional formation of subcutaneous abscesses at the site of injection.

Artificial Termination of the Pregnancy after Eclampsia. It

often happens that when ante partum eclamptic convulsions have been brought under control, the patient does not go into labour. It is useless, and indeed dangerous, in such circumstances to attempt to carry on the pregnancy in order to secure a viable child. If foetal death has occurred the patient always improves, after a lag of two or three days the blood pressure begins to fall, the oedema subsides, and all the other alarming symptoms are alleviated. Spontaneous evacuation of the uterus may then be awaited without anxiety, and further interference is not indicated. If, however, the foetus is still alive the pregnancy should be terminated in a day or two at longest. Caesarean section may of course be carried out, but in our opinion this is seldom necessary or advisable, for the patient is usually a young primigravida, and the performance of Caesarean section may prejudice her whole obstetric future. We prefer rupture or high puncture of the membranes (p 283), which involves little interference and nearly always results in a sufficiently rapid delivery.

After delivery a special watch must be kept on the behaviour of the blood pressure, the daily output of urine, and the amount of albumin in an ordinary swab specimen. At the end of three weeks, or just prior to discharge, a catheter specimen should be obtained for accurate estimation. The bearing of these points on the remote prognosis has been previously discussed (p 346).

Nephritic Toxaemia

In this condition pregnancy has supervened in a woman who is already, before the pregnancy starts, the subject of chronic glomerular nephritis (variously called chronic parenchymatous nephritis or nephrosis).

Frequency The association of chronic nephritis and pregnancy is rare. In twelve years at University College Hospital we have only had seventeen patients in nineteen pregnancies, an incidence of about 1 in 1,000. These were reviewed by Dodds and Browne in 1930.

Pathological Considerations In this we shall closely follow the description by John Gray. The glomeruli show post-inflammatory thickening of the capillary basement membrane and proliferation of the endothelial cells lining the capillaries. The proliferated cells outgrow their blood supply and hence undergo hyaline degeneration, with production of the so called intra capillary hyaline around the lumen. All this leads to

obstruction of the glomerular capillaries. Many glomeruli become completely hyaline and shrunken and ultimately disappear. In the afferent vessels the intima has undergone hyaline thickening, so that the lumen is narrowed. The tubules of the non functioning glomeruli undergo atrophy, partly from disuse, partly because they receive a poor blood supply through the blocked afferent vessels and glomerular capillaries. The obstruction to the glomerular circulation and the destruction of glomeruli lead to retention of waste products. To keep the blood urea from rising a great excess of filtrate has to be passed through the ever-diminishing number of patent glomeruli. Urea is itself a powerful diuretic, and partly accounts for this increased filtration. Another reason is the increased blood pressure, which always ensues as a compensatory mechanism sooner or later. The cause of the hypertension is probably a vascular hypertonus but the exact mechanism of its production is not understood. Arnott and Kellar found that experimental acute glomerulo nephritis was always accompanied by a rise in blood pressure, but that this did not occur if all the nerves to and from the kidney were severed. The increased filtration partly accounts for the low concentration of urea in the urine. Another factor accounting for this is the atrophy of the epithelium of the tubules mentioned above, so that their power of absorbing water from the urine, and thus concentrating it, is diminished. The urine concentrating power of the kidneys as revealed by the urea concentration test (p. 359) is therefore one of the most important tests of kidney function, and, unlike the amount of albuminuria or œdema, is not changed by an acute or subacute exacerbation of the disease. It will be clear that it is a vitally important aid in the interpretation of difficult cases. The excessive filtrate, and the diminished absorption of water in the tubules leads to polyuria, and a urine of low specific gravity. Even the excessive filtration, however, is ultimately unable to prevent the accumulation of waste products in the blood, and sooner or later an increase of blood urea results (p. 341).

Albuminuria is slight in the uncomplicated case, as the glomeruli are no longer hyper permeable as they were in the acute stage. Œdema is slight because there is neither sufficient albuminuria to alter the colloid osmotic pressure of the blood (see p. 312), nor sufficient capillary damage to increase the permeability of the capillaries throughout the body. Thus the factors that lead to œdema in acute and subacute nephritis are absent.

Diagnosis This must be made from pre eclamptic toxæmia and from essential hypertension. In mild cases of chronic nephritis the diagnosis may be exceedingly difficult, yet it is of the greatest importance from the point of view of treatment and prognosis. The following are the points to be relied on in excluding pre eclamptic toxæmia. The diagnosis of essential hypertension will be considered later (p. 362).

(1) In nephritic toxæmia persistent albuminuria with or without hypertension is discovered at a very early stage of pregnancy—before the 20th week. In pre eclamptic toxæmia the onset usually occurs later.

(2) There is usually a *history* of acute nephritis before the pregnancy. This is by far the most important aid to diagnosis and was definitely present in eleven of our seventeen cases.

(3) *Cardio vascular changes* i.e. enlarged heart may be present in nephritic toxæmia but are absent in pre-eclamptic toxæmia.

(4) Hypertension is a less marked feature than in pre eclamptic toxæmia and often appears after the onset of albuminuria.

(5) There is *polyuria* and the urine is of low specific gravity usually below 1010.

(6) *Albuminuric retinitis* when present is very strongly indicative of nephritic toxæmia but it is probable that it may rarely occur in long standing pre eclamptic toxæmia. The matter cannot be said to be finally settled (p. 332). In nephritic toxæmia however albuminuric retinitis may be absent.

(7) There is a *tendency to retention of nitrogen* and a blood urea over 40 mg per cent is suggestive of nephritic toxæmia. In mild cases of chronic nephritis however the blood urea may be little raised.

(8) The *urea concentration* may be below 2 per cent (p. 358), but if it is slightly higher, e.g. 2.5 per cent it does not necessarily exclude nephritic toxæmia. This is one of the most valuable tests of kidney function especially as it is easily carried out.

(9) *The Urea Clearance Test*. This is one of the most valuable of all the tests of kidney function. A urea clearance of 50 or under strongly suggests chronic nephritis if above 50 it does not necessarily mean that mild chronic nephritis is absent. Chesley found in 188 normal pregnant women that the range of the urea clearance was from 28 to 286 per cent the average being 101. His own clearance varied from 45 to 170 per cent. The results of

the test should therefore be interpreted with caution and certainly if a low clearance is obtained the test should be repeated

It will be evident that the differentiation between nephritic toxæmia and pre eclamptic toxæmia often requires prolonged observation and investigation. It can only be satisfactorily done by admitting the patient to hospital, charting the systolic and diastolic pressures twice daily, examining the urine for albumin and casts and carrying out the necessary kidney function tests. Even when all this has been done the diagnosis may still be in doubt and one may then wait till after delivery, when the behaviour of the blood pressure and of the albuminuria may give considerable help. The albumin may disappear permanently in a few weeks, in which case chronic nephritis can be excluded. We have already seen however (p 346), that albuminuria may persist for as much as two years and yet finally clear up and it may be therefore impossible to make a final diagnosis before that time. It should be remembered too that pregnancy in the chronic nephritic is rare (only 17 cases in our clinic in twelve years) whereas pre eclamptic toxæmia is common.

Prognosis Immediate Pregnancy is always liable to cause a fresh exacerbation of the disease with increasing blood pressure albuminuria and œdema and a rising blood urea. Intra uterine death of the foetus is apt to occur in the more severe cases the immediate cause being placental infarction or retro placental hæmorrhage. About half of the milder cases however, go to term with but little disturbance and give birth to live infants. The patients who have severe degrees of chronic nephritis at the start of pregnancy, as evidenced by high blood urea with or without albuminuric retinitis always do badly and should have the pregnancy terminated. Of the mild type we know at present no way of foretelling which will do well and which badly.

Remote This is often very unfavourable. Of our seventeen patients five were dead within the twelve years follow up period (29.4 per cent). Including these about 50 per cent became definitely worse as the result of pregnancy. On the other hand 50 per cent of the series do not seem to be any worse as a result of the pregnancy or pregnancies. This was especially noticeable in the case of one woman who had had both kidneys decapsulated for acute nephritis six years before her first pregnancy and was left with chronic nephritis of apparently mild degree. Since then she has had three live children at term. As far as we can judge by

clinical examination—quantity of albumin blood pressure, kidney function tests and general condition—she does not seem to be any worse than before her first pregnancy. Notwithstanding such favourable cases, pregnancy is always a serious risk in the patient with chronic nephritis even though the disease seems to be mild. Thus, one of our patients had only a mild chronic nephritis (blood urea 20, UCT 8.15, alb 1/1000, fundus oculi normal) and pregnancy was therefore allowed to continue. She aborted at 20 weeks, gradually deteriorated afterwards and died a year later.

Treatment Pregnancy is always a very serious risk for the patient with chronic nephritis and should never be allowed to continue without the gravest consideration, and without apprising the relatives of the danger involved. Let us discuss first of all the severe cases. There can be no doubt that if the blood urea is above 40, if there is albuminuric retinitis and if there is increasing albuminuria, the pregnancy should be terminated at once. What of the milder cases? We have seen in the last section that even in these, though some pass through pregnancy without any demonstrable injury, one can never be sure of a favourable result for either mother or child. It is in our opinion the duty of the medical attendant to advise the relatives that the patient's interests will be best served by terminating the pregnancy forthwith. If they elect to have it continue, a decision in which the patient herself will generally have the chief share, it is possible to hold out a 50 per cent chance that all will be well for mother and child, i.e., that the child will be born alive and the mother's condition not suffer any serious deterioration.

What can be done for such mild cases when it is decided to allow the pregnancy to continue? The most strict supervision is necessary and it is usually advisable to keep the patient in hospital throughout the entire pregnancy. She need not stay in bed all the time, but should do so if the blood pressure shows any marked tendency to rise or the albumin to increase. Anæmia is often an outstanding feature and hæmoglobin estimations should be made at the start of treatment and at intervals thereafter. Blaud's pills, gr xxx, thrice daily, may be given or other suitable preparation of iron. The diet should contain very little red meat, but should include at least 1½ pints of milk daily, butter, fruit, cheese, greenstuffs, and fish liver oil. A sufficiency of vitamin B must be ensured by giving Marmite or Bemax. If the patient is not in hospital, special care must be taken to avoid chills and over

fatigue Throughout treatment a careful watch must be kept on the blood pressure (twice daily readings), the albumin (daily estimates and weekly in a catheter or swab specimen), the weight (weekly weighings), the fundus oculi (once weekly) and the foetal heart sounds Should much œdema develop the possibility should be kept in mind that it may be due to the long-continued leakage of albumin in the urine, and a high protein diet as recommended by Strauss (p 312) may be tried and the effect closely watched

At or after the end of the 36th week it is usually advisable to carry out Cæsarean section with or without sterilization Before the operation is decided on, it is necessary to make sure that the fœtus is still alive, and that it is large enough to survive It must not be forgotten that the child in these cases is apt to be small and undernourished because of the chronic placental infarction so often present and this must be taken into account in estimating the chances of survival Foetal cephalometry (p 546) in such cases is of great value as a safeguard against the too premature termination of pregnancy and should seldom be omitted Vitamin K (p 65) should be administered to the mother before labour or delivery as a prophylactic of hæmorrhage during birth or in the neo-natal period

Occasionally in cases that are being treated expectantly, a marked and rather sudden deterioration sets in, as evidenced by visual disturbances, retinitis, oliguria, œdema, increasing blood urea and mental changes In such cases it is always necessary to terminate the pregnancy at once without regard to the viability of the child

Essential Hypertension

In this disease which may be discovered for the first time by the routine blood pressure estimations in pregnancy, there is a pre-existing hypertension associated with a generalised arteriolar spasm of unknown origin In the later stages a generalised arteriolar sclerosis may develop Unlike chronic nephritis its occurrence in association with pregnancy is frequent

Pathological Considerations In the earlier stages the kidneys are not affected Later a generalised sclerosis of the arterioles, including those of the kidneys especially the afferent vessels of the glomeruli, develops The lumen of the vessel is gradually narrowed and may be ultimately obliterated, and replaced by

fibrous tissue. This change occurring throughout the kidney leads to nephro sclerosis or granular and contracted kidney. The effect of the change is a reduction in blood flow through the glomerular capillaries, and secondary atrophy of the tubules. Retention of waste products, diminished urine-concentrating power and polyuria finally occur for exactly the same reasons as in chronic glomerular nephritis (p. 358). Albuminuria is slight or absent, as there is no hyper permeability of the glomerular capillaries or epithelium, so also is œdema for none of the factors that commonly give rise to it are present. Death may ultimately occur from uræmia. It must be clearly understood however that the great majority of these patients die from cerebral hæmorrhage or cardiac failure, and that uræmia is the cause of death in only about 8 per cent. Pregnancy is not often associated with these advanced stages of the disease, which usually are found in patients past the child bearing age.

Diagnosis. Essential hypertension complicating pregnancy must be distinguished from (a) pre eclamptic toxæmia and (b) nephritic toxæmia. The following are the chief points to be relied on.

(1) In pre eclamptic toxæmia the blood pressure does not usually rise before the 20th week. In essential hypertension it is found to be elevated from the beginning of pregnancy.

(2) *The previous history.* The patient may be known to have had hypertension before pregnancy began—perhaps dating from a previous pre eclamptic toxæmia.

(3) *The family history.* If the patient has essential hypertension there is often a family history of this disease. If possible the relatives, especially the parents should be examined.

(4) *The blood pressure* is often much higher in essential hypertension than in either pre eclamptic toxæmia or nephritic toxæmia. In the latter we have seen that it is but little raised (p. 350).

(5) *Albuminuria* is often absent in essential hypertension throughout the whole pregnancy, and when present is slight and intermittent.

(6) In essential hypertension tests do not reveal any *diminution of kidney function*. In chronic nephritis (p. 359) they often do. Of course, when arteriolo sclerosis has occurred and involved the kidneys, the tests will show diminished function—in raised blood urea and lessened urea concentration but pregnancy in these advanced cases is rare.

(7) There may be evidence in essential hypertension of cardiac enlargement. This may also be present in nephritic toxæmia, but not in pre eclamptic toxæmia.

(8) There may be sclerotic changes in the retinal vessels, and albuminuric retinitis. The latter is not usually found in pre eclamptic toxæmia (p. 332).

Course and Prognosis *Immediate* The pregnancy may, especially if carefully supervised, proceed to term without any disturbance. There is, however, a great tendency for the blood pressure to rise still further during the pregnancy. This rise does not set in, as a rule, before the 26th week and may be delayed till much later. In many cases this increase of blood pressure is the only evidence noticed of aggravation of the condition, but generally when the blood pressure rises to about 160 mm. or over other signs appear—albuminuria, œdema, vomiting, headaches, visual disturbances, epigastric pain, antepartum hæmorrhage or even eclampsia, and of course the fœtus is extremely likely to die *in utero* or to be aborted. In a series of 239 pregnancies in hypertensive patients recently (1942) studied by Gladys H. Dodds and the author there was exacerbation characterised by rise of blood pressure alone in 61 per cent., in 17.9 per cent. there were additional and more serious evidences of breakdown in the form of albuminuria, œdema, antepartum hæmorrhage (6 cases), eclampsia (2 cases), and serious fundal changes—retinal arterio-sclerosis, hæmorrhages, exudates or papilloœdema (6 cases). In 17 per cent. no exacerbation in any form took place. The immediate maternal mortality is low. Of our 222 patients 2 died at delivery or in the puerperium, one of congestive heart failure, the other of bilateral cortical necrosis of the kidneys. For the fœtus the outlook is not unfavourable. In our entire series of 239 pregnancies the fœtal and neonatal mortality was 16.2 per cent. The chance of successful pregnancy depends largely on the height of the blood pressure at the start of pregnancy. If the initial blood pressure is 150/100 or over the prospect for the fœtus is poor—only 32 per cent. survived in our series. Fœtal death *in utero* is especially liable to occur when albuminuria sets in, but may also take place in its absence, especially if the blood pressure rises to 160 or over.

Remote In our twelve year follow up we have observed 65 patients in 86 pregnancies. Judged by the general condition, height of blood pressure, cardiac and eye changes, etc., pregnancy

did not seem to have any ill effect in 52 of the 65 patients. In 7 the effect of pregnancy was unknown as the condition before pregnancy was unknown. 6 are dead (9.2 per cent). These were all cases of severe and probably malignant hypertension who had, apart from pregnancy, a short expectation of life. The 6 fatal cases were observed in 8 pregnancies, only 3 of which went to term. The average duration of the remaining pregnancies was twenty weeks. In spite of these 6 fatal cases we believe that the large majority of patients with simple hypertension may pass even through several pregnancies, go to term and give birth to live children without suffering any demonstrable deterioration in their condition. We could give many examples in support of this contention from the cases in the series. One of them, Mrs. D, we have observed in 5 pregnancies and in the intervals between them during the years 1929 to 1939. All the pregnancies have gone to term except one that ended at 36 weeks with the birth of a macerated foetus. In 1929, before the first observed pregnancy, began the blood pressure was 160/100, urine albumin free. Now ten years later it is not any higher, the urine is still free from albumin and the general condition seems as good as in 1929. In the last pregnancy (1938-39) blood urea was 16, UCT 2.6, urea clearance 43, highest B.P. 160/80, albumin 0, B.P. on discharge 108/56. In this respect our recent detailed study of cases has only served to confirm the general impression obtained from watching these patients in the hospital wards and in the follow-up clinic for a number of years.

Treatment. Unlike nephritic toxæmia there is as a rule no need to terminate pregnancy before viability. If the child is to be saved the blood pressure must be kept as low as possible. The chief therapeutic measure for this purpose is rest and freedom from worry, which must be as complete as it is possible to secure. The major portion of the day should be spent in bed. The amount of rest must largely depend on the height of the blood pressure and its response to treatment. A mixture containing bromide and chloral in small doses once or twice daily is of value as a sedative and its use should be routine unless the hypertension is easily controlled by rest. Ultra violet light may be tried three or four times weekly, and occasionally seems to be effective in lowering the blood pressure when other methods fail. It should not be used if there is albuminuria as it tends to aggravate it. Venesection is rarely necessary, but its value should be kept in

mind especially if the blood pressure is 180 or over—a dangerously high level. The diet should be largely vegetarian and should include white fish a pint or more of milk daily fresh fruit and green salads. Red meat is better avoided but chicken or rabbit may be eaten in moderation. The quantity of food eaten should be small. Calcium lactate gr xv should be given three times daily together with 9 minims of halibut liver oil or one or two teaspoonfuls of cod liver oil. The value of vitamin K administered to the mother during the last month of pregnancy in prevention of cerebral hæmorrhage in the premature infant is discussed elsewhere (p 65). The bowels should be kept open by mild salines and strong tea and coffee tobacco and alcoholic stimulants should be avoided. When the pregnancy has reached the end of the 36th or 37th week it may be well to carry out Cæsarean section for the sake of the child but other methods of termination may be considered e.g. bougie induction. Termination by rupture of membranes is undesirable as it leaves the dilatation of the cervix to be done by the soft head of the premature foetus. It should be remembered that as in nephritic toxæmia the foetus is often unduly small for the period of pregnancy and this has to be kept in mind in deciding whether and when pregnancy is to be artificially terminated.

After delivery the behaviour of the blood pressure should of course be carefully watched. It may be thought advisable to give contraceptive advice for it is in general unwise for the subjects of essential hypertension to indulge in many or frequent pregnancies. The question of sterilisation either at the time of performing Cæsarean section or at the end of the puerperium should be given full consideration.

Acute Yellow Atrophy of the Liver

In the past several really distinct conditions have been included under this term. We are indebted to Sheehan for clarifying the subject and the following description is largely based on his recent work. The cases fall into four groups.

(1) *True acute yellow atrophy* which is extremely rare in pregnancy only two cases having been reported. Its occurrence in pregnancy is probably only a coincidence. The clinical picture is similar to that in the non pregnant—vomiting rapidly deepening jaundice, coma and death. At post mortem examination the liver

is shrunken and yellow, and necrosis is almost universal throughout the liver and affects the entire lobule

(2) *Obstetric Acute Yellow Atrophy* Clinically this condition is very like true acute yellow atrophy. At the 36th to 40th week there is a sudden onset of severe vomiting and epigastric pain followed in a few days by jaundice. These symptoms progress rapidly, the jaundice becomes intense, the vomit like coffee grounds in appearance, and there may be headache. After 7 to 12 days the patient is delivered of a dead born and macerated foetus, becomes comatose and dies in two or three days. At *post mortem* the lesion invariably found is a gross fatty change affecting the entire lobule except a narrow rim of cells around the portal tracts. There is no necrosis and thus it differs entirely from true acute yellow atrophy. Its aetiology is not known. Clinically it has to be differentiated from true acute yellow atrophy, toxic necrosis of the liver caused by chloroform, atophan, salvarsan or phosphorus, catarrhal jaundice and cholelithiasis.

(3) *Delayed Chloroform Poisoning* This condition most often follows administration of chloroform to patients who have a starvation acidosis as found, for example in those who have been partly starved for pre eclamptic toxæmia or hyperemesis, or who have been a long time in labour without receiving sufficient glucose. The condition of the patient in this respect seems to matter at least as much as the amount of the anæsthetic used. *Microscopically* Sheehan describes three types of lesion in the liver. (a) *Isolated cell necrosis*, in which there is necrosis of individual cells throughout the lobule leaving those immediately around them apparently untouched. (b) *Mid zonal necrosis*—the most frequent. In severe cases the necrosis may extend inwards and involve the centre of the lobule. There is no fatty change. (c) *Central necrosis*. The lesion starts at the centre of the lobule and proceeds outwards. This type is most commonly seen in hyperemesis patients who are extremely susceptible to small doses of chloroform. Clinically the course is similar to that described above for true acute yellow atrophy. The patient has had a long or short chloroform anæsthetic for termination of pregnancy in hyperemesis or pre eclamptic toxæmia, or for the operative termination of a prolonged labour during which inadequate amounts of glucose have been administered. Jaundice sets in about the second day after delivery, followed by restlessness and coma. With energetic treatment recovery may take place.

(4) *Liver Injury due to other Poisons* The chief of these are phosphorus, mercurv, arsenical compounds and cincophen and its derivatives

In all forms the chief chemical changes are decrease of the blood sugar and urea nitrogen, and increase of the uric acid and amino acids, and in the urine diminution of urea and increase of the ammonia nitrogen

Treatment The patient should be put at once on continuous intravenous glucose saline, as advised for severe hyperemesis (p 305) Following the work of Minot and Cutler (p 315), calcium gluconate should be injected intramuscularly, or intravenously, 10 c c of a 10 per cent solution being given daily. The pregnancy should be terminated as soon as the condition is diagnosed, preferably by Cæsarean section under local anæsthesia Chloroform or ether anæsthesia should be avoided

It is necessary to warn against the prolonged administration of chloroform during pregnancy or labour, especially in those patients who have been starved and have acidosis, on account of the risk of causing delayed chloroform poisoning Arsenical preparations, too, in the treatment of syphilis in pregnancy should always be administered with caution, care being taken that the bowels are freely acting and treatment being stopped immediately should the slightest evidence of jaundice appear The value of calcium and glucose as a prophylactic should be borne in mind (p 315)

REFERENCES

- ANSELMINO, K. J., HOFFMANN, F., and KENNEDY, W. P. *Ed Med Jour*, New Series 1932 39, 376
 ARNOTT, W., MELVILLE, and KELLAR, R. J. *Jour of Path and Bact*, 1936, 42 No 1, p 141
 BAADER OTTO *Zent f Gyn*, 1939, 63, 1111
 BAIRD, D., and SHAW DUNN, J. *Jour Path and Bact*, 1933, 37, 291
 BARBER HUGH *Guy's Hosp Rep*, 1934 84, 267
 BELL, E. T. *Amer Jour Path*, 1932 8, 1
 BIGGART, J. H. *Trans Edin Obst Soc*, 1934-5, 55, 113
 BROWNE F. J. *J Obst & Gyn Brit Emp*, 1940 47, 365
 BROWNE, F. J., and DODDS, GLADYS H. *Ibid*, 1939, 46 443
 BROWNE, F. J., and DODDS, GLADYS H. *Jour Obst & Gyn Brit Emp*, 1942, 49, 1
 BYRON, F. B. *Jour Path & Bact*, 1937, 45, 1
 CADDEN, J. F., and STANDER, H. J. *Amer Jour Obst & Gyn*, 1939, 37 37
 CHESLEY, L. C. *Amer Jour Obst & Gyn*, 1939, 38 430
 CHESLEY, L. C. *Jour Clin Investigation*, 1939, 18, 617
 CHESLEY, L. C., MARKOVITZ, I., and WETCHLER, B. B. *Jour Clin Investiga-
 tion*, 1939 18, 51
 CLOW, F. E. *New England Jour of Med.*, 1928, 198, 351

- COOK, IRANK *Guy's Hosp Rep*, April, 1924, 172
- COPE, CUTHBERT L. *Lancet*, 1940, ii, 158
- COPE CUTHBERT L. *Brit Med Jour* 1940, 2, 545
- CORCORAN, A. C., and PAGE, IRVINE H. *J A M A*, 1941, 116, 691
- CORWIN, J., and HERRICK, W. W. *Amer Jour Obst and Gyn*, 1927, 14, 783
- CRICHTON, I. C. *South African Med Jour* 1932 2 332
- CUSHINGS, H. H. *Amer Jour Obst and Gyn* 1937 27, 808
- CUSHING, H. *Amer Jour Path*, 1934, 10, 145
- DAVIDSON, J. *Trans Edin Obst Soc*, 1930-31 51, 24
- DESSER, A. L. *Amer Jour Obst & Gyn*, 1927, 13 647
- DE VALERA, E., and KELLAR, R. J. *Jour Obst and Gyn Brit Emp* 1938 45, 815
- DE WESSELOW, O. L. V. *Jour Obst & Gyn Brit Emp*, 1922, 29, 21
- DILCKMANN, WM J. *Amer Jour Obst & Gyn*, 1938, 36, 623
- DIECKMANN, W. J., and KRAMER S. *Im J Obst & Gyn*, 1941, 41, 1
- DIECKMANN, WM J., and MICHEL, H. L. *Amer Jour Obst & Gyn* 1937 33, 131
- DIECKMANN, W. J., MICHEL, H. I. and WOODRUFF, PAUL W. *Amer Jour Obst & Gyn*, 1938, 36, 408
- DIECKMANN, W. J., and WEGNER C. R. *Arch Int Med* 1934 53 71
- DILL L. V., and LEICKSON, C. C. *Proc Soc Exp Biol & Medicine*, 1938 39, 362
- DODDS, GLADYS H., and BROWNE, F. J. *Proc Roy Soc Med*, London, 1930-40, 33, 737
- DOGGART, J. H. *Proc Roy Soc Med*, 1935-36, 29, 753
- LDEN, T. WATTS *Jour Obst and Gyn Brit Emp*, 1922 29, 386
- EVANS, M. D. ARWYN. *Brit Med Jour* 1937, i 157
- LAHR, TH. *Hinselman's Die Eklampsie Bonn*, 1924 200
- FRIEDENWALD, J. S. *Ibman Anniversary Volumes New York*, 1932 2 453
- GERNEZ, L., and DEMAREZ R. *Bull de la soc d'obstetrique et de gynécologie de Paris*, 1937, 26, 76
- GIBBERD, G. F. *Proc Roy Soc Med Lond*, 1928 21, No 5 811
- GOLDBLATT, H. *Biochemical Journal*, 1923, 17, 208
- GUTTMACHER, ALAN F. *Amer Journal of Obst & Gyn*, 1939, 38, 277
- HALLUM, A. V. *Jour Amer Med Assoc*, 1936 106, 1649
- HARDING, VICTOR J., and VAN WYCK, H. B. *Amer Jour Obst and Gyn* 1932, 24, 820
- HARRIS, J. W. *Johns Hopkins Hosp Bull* 1924 35, 103
- HERRICK, W. W., and TILLMAN, A. J. B. *Archiv Int Med* 1935 55, 648
- HERRICK, W. W., and TILLMAN A. J. B. *Am Jour Obst and Gyn* 1936 31, 832
- HEYNEMAN, TH. *Zent f Gyn*, 1934, 58, 3010
- HINES, E. A., and BROWN, G. E. *Collected Papers of the Mayo Clinic and the Mayo Foundation*, 1933, 25, 607
- HINES, E. A. and BROWN, G. E. *Ibid*, 1935, 27, 583
- HOFFMANN, F., and ANSELMINO, H. J. *Archiv f Gyn*, 1931, 147, 652
- HOLLAND, FARDLEY. *Jour Obst and Gyn Brit Emp*, 1921, 28 303
- HILWITZ, D., and BULLOCK, L. T. *Am. Jour Med Sci* 1935, 189, 613
- JARDINE, R. *Trans Edin Obst Soc*, 1905-6, 31, 162
- JARDINE, R., and KENNEDY, A. M. *Trans Edin Obst Soc*, 1912-13, 38, 158
- JONES, GRACE. *Proc Roy Soc Med*, London, 1937, vol 30, part 2, 1240.
- KELLAR, R. J., and ARNOTT, W. M. *Edin Med Jour*, 1933, 40, 101
- KELLAR, R. J., ARNOTT, W. M., and MATTHEW, G. D. *Jour Obst and Gyn Brit Emp*, 1937, 44, 320

- KELLOGG F S *Amer Jour Obst and Gyn* 1924 8 313
 KELLOGG F S *Im Jour Obst and Gyn* 1922 3 366
 KOBES R *Zent f Gyn* 1930 54 : 660.
 KUSTNER H *Arch v f Gynak* 1931 145 377
 LAUN *Zent f Gynak* 1928 52 : 19
 LENNON G GORDON *Brit Med Jour* 1938 : 944
 LEVITT G *Jour Clin Invest* 1936 15 133
 LOUROS N and PANAJOTOU P *Zent f Gyn* 1938 67 1078
 McLANE C M *Amer J Obst & Gyn* 1939 38 11
 MENDENHALL A M and DRAKE J C *Amer Jour Obst and Gyn* 1934 27
 800
 MINOT A S and CUTLER J T *Jour Clin Invest* 1928-29 6 369
 MYLIUS I *Abhandlungen aus der Augenheilkunde* 1927-8 6-10 1
 PAGE IRVINE H *Jour Exp Med* 1939 70 501
 PARASORE R H *Jour Obst and Gyn Brit Emp* 1929 36 341
 PARASORE R H *Jour Obst. and Gyn Brit Emp* 1932 39 777
 PETERS JOHN P LAVIETTES P H and ZIMMERMAN H M *Amer Jour Obst
 & Gyn* 1936 32 911
 PECKHAM C H and STOUT M L *Im Jour Surg* 1936 31 92.
 PICKERING G W *Brit Med. Jour* 1939 : 1
 REESE J M and PEYTO F W *Amer Jour Obst & Gyn* 1938 36 130
 ROBSON J M and PATERSON S J *Brit Med Jour* 193 : 311
 ROSE R A et al *Amer Jour Obst & Gyn* 1938 35 426
 ROYCE L G *Arch Int Med* 1923 32 157
 SCHMECHSEL A *Zent f Gynak* 1929 53 : 405
 SCHÖRL G *Pathologisch Anatomische Untersuchungen über Puerperal
 Eklampsie* Leipzig 1893
 SCHOCKAERT J A and LAMBILLON J *Bruxelles Med col* 193 17 : 1468
 SCHROEDER — *Berliner kl Woch* 1878 15 559
 SCHULTZ W *Munch Med Woch* 1933 80 n. 1972.
 SCHWEN W DE M and OERTEL, H *Jour Path and Bact* 1930, 33 1071
 SHEEHAN H L *Jour Obst & Gyn. Brit Emp* 1941 47 49
 SIDDALL A. C *Amer Jour Obst & Gyn* 1938 35 662
 SIDDALL R S and MACK H C. *Am. Jour Obst and Gyn* 1933 26 244
 SLEMON J M *Am Jour Obst.* 1913 67 849
 SMITH G VAN S and SMITH O WATKIN. *SGO* 1935 61 77
 SMITH O WATKIN and SMITH G VAN S *Amer Jour Obst & Gyn* 1937
 33 365
 SMITH O WATKIN and SMITH G VAN S *Ibid.* 1940 39 405
 SOLOMONS BETHEL, *Jour Obst and Gyn Brit Emp* 19 29 41
 STANDER H J and RADELET A. H *Bull. Johns Hopkins Hosp* 1926 38,
 403
 STRAUSS M B *Am. Jour Med Sc* 1935 190 811
 STROGANOFF W *The Improved Prophylactic Method in the Treatment
 of Eclampsia.* Livingstone Edinburgh 1920
 STROGANOFF W and DAVIDOVITCH O *Jour Obst. and Gyn Brit Emp* 1937
 44 289
 SYM JESSIE B *Lancet* 1920 : 698
 TAYLOR H C. and SCADRON E. N *Amer Jour Obst & Gyn* 1939 37 963.
 THEOBALD G W *Lancet* 1920 : 1115
 THEOBALD G W *J Obst & Gyn* 1932 39 854
 THEOBALD G W *Clinical Science* 1933-34 1 225
 THEOBALD G W *Lancet* 1933 : 676
 THEOBALD G W *Brit Med Jour* 1933 11 876

- THEOBALD, G W *Proc Roy Soc Med London*, 28, 1933, 1388
- THORN, G W, NELSON, K R, and THOM, DONIS W. *Endocrinology*, 1938, 22, 153
- TWEEDY, H "Practical Obstetrics" (Tweedy & Wrench.) 4th ed, 1910, 173
- VARO, B *Zeit f Gynäk*, 1920-21, 44, 522
- VOLHARDT, F *Handbuch der inneren Medizin, Zweite Auflage* 6 : 632
- WAGNER, H P *Jour Am Med Assoc*, 1933 101, 1881
- WARE, H H, and NOBLIN, F C *Southern Medical Jour*, 1937, 30, 153
- WEIR, J F, LARSON, E C, and ROWNTREE, L G *Archiv Int Med*, 1922, 29, 306
- WEISS S *New England Med Jour*, 1910 223 939
- WHITE, CLIFFORD *Proc Roy Soc Med Lond*, 1919 xii (Sect Obst & Gyn) 27
- YOUNG, JAMES *Proc Roy Soc Med London*, 1914 7, 307
- YOUNG, JAMES *Brit Med Jour*, 1920 i, 91
- ZANGEMEISTER, W. *Zeits f Geb u Gynäk* 1915-16 78, 323
- ZIMMERMAN, H M, and PETERS, JOHN P *Jour Clin Investigation* 1937, 33, 897

CHAPTER XXII

DISEASES AND DISORDERS OF THE DIGESTIVE SYSTEM IN PREGNANCY

Appendicitis

FROM the 3rd month of pregnancy onwards the appendix is shifted gradually upwards by the growth of the uterus, so that at the 6th month it lies at the level of the iliac crest. At the end of the 8th month it has reached its highest point, about two finger breadths above the iliac crest. This change in the situation of the appendix has important bearings on the diagnosis and prognosis of appendicitis in pregnancy.

Pregnancy does not seem to predispose to a first attack of appendicitis but if there has been a previous attack, and especially a recent one the upward shifting of the appendix with stretching of adhesions, and possibly the increased vascularity of the organs tend to cause recurrence. Hence appendicitis in pregnancy is most often due to recurrence of an old attack. In a series of 28 cases reported by Baer there was a clear history of repeated attacks before pregnancy in 14. This view as to the important part in causation played by upward displacement receives support from the fact that the time of onset of the attack is most often after the 3rd month.

Clinical Features These are much the same as in the non pregnant—sudden onset of colicky or continuous pain in the lower epigastrium followed by nausea and vomiting and later by tenderness and rigidity in the right iliac fossa, constipation, dry tongue, quickening of the pulse and leucocytosis. After the 3rd month the pain is felt at a progressively higher level, corresponding to that at which the appendix lies. Thus at the 6th month it may be at the level of the iliac crest at the 8th or 9th month in the vicinity of the liver. Tenderness too is always most marked directly over the appendix at whatever level it happens to be and so may be noted at a much higher level than McBurney's point. It may be entirely absent if the appendix is a pelvic one. Here tenderness may only be found *per rectum*. The temperature is often normal or even subnormal and the pulse frequency is often greater than one would expect from the height of the temperature but sometimes it is but little above normal.

Diagnosis It is probable that mild attacks of appendicitis in pregnancy are often overlooked because the pain and sickness are regarded as part and parcel of the various discomforts natural to pregnancy. For the same reason diagnosis and treatment are liable to be delayed with disastrous results. Apart from this diagnosis up to the end of the 3rd month is no more difficult than in the non pregnant woman. After this time pain and tenderness are at a higher level in the abdomen and the differential diagnosis becomes correspondingly difficult. This is especially the case if the uterus is contracting as the pain and sickness are then liable to be ascribed to labour.

As appendicitis in pregnancy is usually due to recurrence of a previous attack, it is always important to enquire regarding these. The chief difficulty will be found in diagnosis from pyelitis gravidarum, for the diseases may simulate each other very closely. The following points will generally help to distinguish between them.

(1) In pyelitis the pain is often of an aching character and felt only in the lumbar region. It may however be felt in the right side of the abdomen only, or may even in very severe cases be diffused over the front of the abdomen.

(2) In pyelitis the tenderness is often localised in the right costo vertebral angle and tenderness and rigidity are absent over the appendix.

(3) In pyelitis the temperature tends to be higher and in proportion to the temperature the pulse is good. The general condition of the patient is better than in appendicitis.

(4) In pyelitis the tongue is moist. In appendicitis it is apt to be dry.

(5) *Hyperæsthesia in Appendicitis* In appendicitis there is often an area of epicritic hyperæsthesia in the right flank. It is probably best demonstrated by Ligat's method which is thus described by Hamilton Bailey. A portion of skin and subcutaneous tissue is picked up between the finger and thumb off the abdominal musculature. The portion of skin is picked up as in pinching but it should be carefully noted that the skin is *not* pinched. We begin in the left iliac fossa, pass up to the right hypochondrium, and then work down the right side, finally picking up the portion of skin in the right iliac fossa where we anticipate that hyperæsthesia may be found. There is no need to question the patient as one can discern the onset of pain by a change in the facial

expression The hyperæsthesia, when present, is found in a triangular area (Sherren's triangle), bounded by lines joining the following points (1) the highest point of the iliac crest, (2) the right pubic spine, (3) the umbilicus It may, however, be absent.

(6) The value of the single drop method of examination of the urine in diagnosis of pyelitis will be discussed later (p 484) We believe this method to be reliable except in the rare cases in which appendicitis and pyelitis coexist, and it should always be employed in differential diagnosis The test can be done rapidly and without the use of any apparatus except a microscope Culture of the urine is entirely unsuitable, and might be misleading, because, as explained later (p 479), the urine of normal pregnant women gives a growth of bacillus coli on culture in 11 per cent of cases The presence of bacillus coli on culture therefore cannot be regarded as evidence of pyelitis. Usland (quoted by Pankow) has stated recently that in acute appendicitis there is a special liability to bacillus coli infection of the urine, due, he thinks, to a blood stream infection He found it in 16 out of 34 patients with acute appendicitis, the urine from both kidneys being affected In 5 cases of chronic appendicitis he found the bacteria in the urine from the right kidney only, due, apparently, to a lymph stream infection of the right kidney How far these recent observations will affect the usefulness of the single drop method of examination of the urine as a means of diagnosis between pyelitis and appendicitis it is as yet impossible to say Further observations are much needed

Diagnosis may also be necessary from such conditions as ruptured tubal pregnancy (not very important, as operation is the best treatment in both), right basal pneumonia, cholecystitis, renal colic, ovarian cyst with twisted pedicle, torsion of the right Fallopian tube, diverticulitis, intestinal obstruction, mesenteric thrombosis, etc In a difficult case it is always better to give the patient the benefit of the doubt, and carry out exploratory laparotomy as soon as possible, rather than waste time in prolonged and often futile attempts at differential diagnosis

Prognosis In non pregnant women the mortality from acute appendicitis is in the neighbourhood of 10 per cent With this the mortality in the pregnant woman compares most unfavourably. In the series of 486 cases collated by Schmidt it was 30 per cent. How can we explain this ? It appears to be due to several factors (1) The displacement of the appendix into the upper part of the

abdominal cavity, which is notoriously less able to deal with infections, and where there is less likelihood of the formation of protective adhesions. General peritonitis is therefore likely to occur rather than abscess formation, and the risk of this is greater when the patient is near term. (2) Delay in diagnosis. This delay is due not only to increased difficulty in diagnosis after the 3rd month, but also to the fact that there is a tendency to regard pain, nausea, and vomiting as almost normal accompaniments of pregnancy, to which it is unnecessary to pay much heed. In fact, *the mortality of appendicitis in pregnancy is to a large extent a mortality of delay*. The prognosis rapidly worsens after the first twenty four hours. If, according to Pankow, operation can be carried out within the first forty eight hours the prognosis is no worse than in the non pregnant. (3) It is said that appendicitis in pregnant women progresses much more rapidly to gangrene and perforation. The reason for this is not clear, nor indeed is it certain that such is really the case. There is no doubt that *gangrene and perforation are unusually frequent* (15 out of Baer's 28 cases), but this is possibly due to the delay in diagnosis. (4) The risk of premature termination of pregnancy which is the greater the further the pregnancy has advanced. It occurred in 12 per cent of Schmidt's 486 cases. In the more severe cases, with gangrene, perforation or general peritonitis the risk of abortion is very great (59.4 of Jerlov's series). In the milder cases it was only 20 per cent. This liability to premature interruption of pregnancy is not due to manipulation of the uterus during operation, for it is present whether operation is carried out or not and probably arises from peritoneal irritation. Possibly the raw absorptive surface left in the uterus after abortion predisposes to generalised infection.

Treatment. It is hardly necessary to warn against the administration of a purgative in any case where there is a question of appendicitis, as the bowel peristalsis caused thereby may precipitate perforation. The only treatment for appendicitis in pregnancy is operation, and this should be undertaken with the least possible delay. A right paramedial incision is best as it permits free exploration, with a minimum of muscle and uterine trauma. The appendix should be removed if possible but if it cannot be easily found, it is better, if there is an abscess or general peritonitis, to insert a drain than to spend much time in looking for it. The uterus should be handled as little as possible.

As regards the anæsthetic to be used Brindeau and Juge condemn spinal anæsthesia as they say it can cause uterine contraction, and thus promote the supervention of premature labour. They advise chloroform or ether.

Dental Caries

We have already seen (p. 57) that there is no evidence that dental caries is more liable to take place during pregnancy than at other times. Cleansing of the teeth especially at night is however of great importance in its prevention for it is probable that decay is hastened by bacteria and by acids formed during the fermentation of carbohydrates that have gathered around them. We have already seen that decayed teeth should be promptly attended to during pregnancy (p. 74). It is said that teeth with large cavities that have been previously painless are liable to become painful in pregnancy, possibly from increased hyperæmia or œdema of the intra dental tissues.

Gingivitis

A soft and pulpy condition of the gums with a tendency to bleed easily, is probably an early manifestation of scurvy and therefore of a deficiency of vitamin C and possibly of calcium or it may be due to pyorrhœa.

Excessive Salivation

Mild degrees of this distressing complaint are not uncommon in pregnancy, but serious cases are very rare. In the latter the expectoration may amount to as much as 1500 c.c. daily of clear alkaline fluid. Partly from loss of fluid partly because it prevents sleep there may in such cases be rapid wasting. Broissard recorded a case in which the patient lost 18 kilos (about 30 lbs.) in weight in seven days. The cause of excessive salivation is unknown but it has been attributed to a neurosis to pregnancy toxæmia and to ovarian deficiency. Treatment may be in the first instance, by astringent mouth washes injection of atropine sulphate or oral administration of belladonna to the limit of tolerance, but usually little benefit is obtained. Theobald obtained immediate cure in one case by injection of 10 c.c. of calcium gluconate.

Constipation

Constipation is one of the most common disorders to which pregnant women are liable and is largely due to taking too little

fluid and restriction of outdoor exercise. A contributory factor may be the diminished tone of the muscular coat of the intestine which appears to be characteristic of the involuntary muscle generally during pregnancy. It is of the first importance to secure a free motion at least once daily, and by far the best time is immediately after breakfast and an attempt, even if it is not always successful should be made at that time. In the prevention and cure of constipation proper exercise and diet are more important than drugs. Taking a sufficiency of fluids, eating fresh fruit, green vegetables, brown bread and oatmeal porridge (at breakfast), and drinking a glass of hot water immediately before or just after rising in the morning, are all laxative in their effects. Marmalade with breakfast is very useful as not only are the vegetable salts and sugar it contains laxative in their effects, but the pieces of hard orange skin act as a mechanical stimulus to the bowel. If these measures are insufficient a teaspoonful of the liquid extract of cascara sagrada or half a teaspoonful each of this and the liquid extract of liquorice should be taken at bed time. Five grains of a colocynth and hyoscyamus pill or one or two vegetable laxative pills are also safe and useful remedies that may be taken if pills are preferred to medicine. Besides these, there are on the market various satisfactory and pleasant proprietary preparations that it is unnecessary to specify. A very good home made remedy is stewed prunes and to make them more effective it is a useful plan to tie some senna leaves in a muslin bag and put them into the pan beside the prunes to be stewed. Castor oil is very useful occasionally and has the advantage that it acts quickly. One or two tablespoonfuls may be taken as a dose, but it is not suitable for constant use as it tends to constipate afterwards.

Acidity or Heartburn

This is very common during pregnancy, fully 60 per cent of patients suffering from it in greater or less degree. It may be troublesome even in the early months, and is often worst at night, and may keep the patient awake. Some cases are associated with deficiency or absence of hydrochloric acid in the gastric juice, which recent studies, especially in connection with the anæmias, have shown to be common in pregnancy. These are generally cured by taking 20 minims of dilute hydrochloric acid well diluted with water, and flavoured, if necessary, by orange juice, with or

immediately after meals. In other cases there is a true hyperacidity, and such are relieved by sipping a small tumblerful of hot water in which a teaspoonful of bicarbonate of soda is dissolved or by swallowing 2 or 3 soda mint tablets (Tab Sod Bicarb Co B P C).

In all, special attention should be paid to the diet, the care of the bowels, and outdoor exercise. Fatty, greasy and fried foods should be avoided, as well as pastry and cake. Dry toast should be eaten and stale bread rather than fresh. No drink should be taken with meals, but only two or three hours after. Before rising in the morning a tumblerful of hot water in which half a teaspoonful of Epsom salts is dissolved should be drunk slowly.

Hyperemesis Gravidarum (see p 297)

Intestinal Parasites

The treatment of these is better postponed till after delivery, as the somewhat drastic measures employed are apt to induce abortion or premature labour.

Hæmorrhoids

These are partly due to pressure, but are no doubt chiefly caused, like varicose veins, by the increased vascularity of the pelvic organs in pregnancy, and the consequent turgescence of the tributaries of the great pelvic veins. They are, however, aggravated by constipation. The bowels should be attended to by a mild purgative like the confection of senna or sulphur, a teaspoonful of either being taken at bed time. The piles should be gently bathed with cold water, an ointment containing galls and opium or hazel-nut smeared on, and an attempt made to push them back with the finger. In severe cases much relief may be obtained by applying to the piles a piece of soft flannelette soaked in warm castor oil.

Typhoid Fever

Though nowadays rare, sporadic cases still occur occasionally. The organism is often transmitted to the fœtus across the placenta, and according to Hicks and French, who in 1905 reviewed the literature up to that time, it is more likely to be found in its tissues if the child has been born late in the course of the disease. The fœtal and cord blood may give positive Widal reactions, due,

it is believed, to the formation by the foetus of its own agglutinins rather than to passive transmission from the mother

A unique case has been recently reported by Wing and Tropoli, in which a woman convalescing from typhoid gave birth to a convalescent infant. The child, which weighed 1 lbs., had a temperature of 100° F. at birth, with positive stools, and its cord blood gave a positive Widal reaction. Repeated cultures of the mother's breast milk failed to grow the bacillus, but the breast milk gave a positive Widal in a dilution of 1 in 10.

Pregnancy, according to Hicks and French has no influence on the course of the typhoid fever, as the mortality is about the same in the pregnant and non pregnant. The disease, however, causes abortion or premature labour in from 60 to 80 per cent. of cases. Treatment is the same as in the non pregnant and termination of the pregnancy is not indicated.

Gall Stones and Cholecystitis

As gall stones are so often present in women, especially of middle age (Peterson found them in 11.8 per cent. of 542 women whose gall bladders he palpated during abdominal operations for other conditions) it is not surprising that they sometimes give rise to trouble during pregnancy. Indeed, pregnancy seems to predispose to them, and to the onset of cholecystitis. This is probably due mainly to the increase of cholestrin, but there are no doubt many other accessory factors, such as atony of the gall-bladder, want of exercise, constipation, limitation of the movement of the diaphragm, compression of the upper part of the abdomen by tight lacing, and of the bile passages by the enlarging uterus. All these interfere with the drainage of the gall bladder, lead to stasis, and thus to the formation of gall stones and to infection and cholecystitis. It is probable, too, that the hypochlorhydria or achlorhydria so common in pregnancy is an important contributory factor. In the absence of free hydrochloric acid which is important in maintaining the sterility of the stomach and upper part of the small intestine there is a favourable medium for the growth of bacillus coli which infects the duodenum, and often leads to an ascending infection of the bile ducts. The clinical features are the usual ones—pain and tenderness in the right hypochondrium, chills, often pyrexia, and sometimes jaundice (always if a stone is lodged in the common duct). The patient is usually a multipara, and often there is a history

of previous attacks. The diagnosis must be made from pyelitis, appendicitis, duodenal ulcer, renal colic and pneumonia. In the puerperium the condition is liable to be confused with puerperal sepsis. There is some tendency to abortion and premature labour. In 23 cases collected by Peterson pregnancy was interrupted in 5—2 before and 3 following operation. Treatment should in the first instance be palliative by alkaline aperient drinks and hot applications. Morphine is especially indicated in view of the tendency to miscarriage. Operation should be delayed if possible till after delivery but the symptoms may be so urgent as not to admit of delay and then the pregnancy should be disregarded. The patient should be kept under morphine for four days afterwards.

REFERENCES

- BAER J. L., REIS R. A. and AREUS R. A. *Jour Am Med Assoc* 1937 98 1359
 BAILEY HAMILTON. *Demonstrations of the Physical Signs in Clinical Surgery*. 4th ed. Wright & Sons, Bristol, 1933.
 BRINDEAU A. and JUGE C. *Gynec et Obstet* 1906 14 143
 BROISSARD. *Jour Obst and Gyn Brit Emp* 1910 17 560 (Abst.)
 HICKS H. T. and FRENCH H. *Lancet* 1903 1 1491
 JERLOV E. *Klinische Studie Acta Gynec Scand* 1923 4 1
 PANKOW O. *Arch v f Gynak* 1908 133 5
 PETERSON R. *Trans Amer Gyn Soc* 1910 35 84
 RODWAY HELEN E. and SHELLEY U. *Jour Obst and Gyn Brit Emp* 1935 42 107
 SCHMIDT H. H. *Jour Am Med Assoc* 1911 57 349 (Abst.)
 WING E. S. and TROPOLI D. V. *Jour Am Med Assoc* 1930 95 403

CHAPTER XXIII

DISEASES OF THE CIRCULATORY SYSTEM IN PREGNANCY

Heart Disease

CONSIDERABLE discussion has centred round the question as to whether the healthy heart during pregnancy is hypertrophied or not. Post mortem examinations have usually failed to show either hypertrophy or dilatation, and X ray examinations have been inconclusive, chiefly on account of the fact that during pregnancy and especially in its later months the heart is displaced upwards and outwards by the enlarged uterus. Gammeltoft has lately made systematic X ray and electro cardiographic examinations of women at all stages of pregnancy. The X ray examinations showed an increase in both the longitudinal and transverse diameter, which was often demonstrable as early as the 4th month, and therefore at a time when pressure on the diaphragm could not be of consequence. As a result of the electro cardiographic examinations the following conclusions were reached: "During the first six months the left ventricle undergoes a relative hypertrophy in proportion to the right ventricle and from the 6th month to parturition this hypertrophy is compensated by a hypertrophy of the right half of the heart. There is perhaps also a slight dilatation of the right ventricle and right atrium." The changes can be demonstrated as early as the 3rd or 4th month.

As the uterus enlarges and displaces the diaphragm the heart is pushed upwards and rotated to the left, so that the apex beat is found in the fourth interspace and 1 inch outside the nipple line. The thorax, too, is widened so that its circumference may be from 2 to 6 inches more than in the non pregnant state. The lungs, especially their bases, are compressed so that respiration tends to be shallow and imperfect, and this gives rise to embarrassment of the pulmonary circulation, and consequently, to some extent of the right ventricle. At the same time more work is required of the heart in consequence of (a) the increased weight of the pregnant uterus and the growth of its contents, (b) the necessity for maintaining the placental circulation, (c) the increase in the "minute volume" i.e. the quantity of blood

passing through the heart per minute, due to the rise in the blood volume. Various reliable estimates have shown that the minute volume increases steadily till about the 37th week, when it may be as much as 60 per cent greater than before pregnancy began. For all these reasons the reserve force of the heart is called on more than in the non pregnant state, and a healthy heart muscle is necessary to bear the increased strain.

Functional Disorders of the Heart in Pregnancy It is well recognised that even in normal pregnancy various circulatory functional disturbances may occur, such as dyspnoea, valvular murmurs, extra systoles, etc., which are liable to be ascribed to organic disease. The chief complaints of these patients are cardiac pains and distress and shortness of breath. Objective signs may be present, such as increased pulse rate, functional murmurs and extra systoles. These signs occur with increasing frequency as pregnancy advances and are most often met with in the 9th month. The condition is not aggravated by work nor improved by rest, and the patient may even feel better while moving about. It is characteristic that there is no aggravation of the symptoms during labour, which these patients bear remarkably well and that all the signs and symptoms including the murmurs disappear very soon after delivery. It is important, especially in any statistical studies of the influence of pregnancy on organic heart disease, that these cases should be recognised and excluded. Seitz draws attention to the condition which he designates "goitre heart" which may be present in slight degrees of hyperthyroidism in pregnancy, and which is characterised by palpitation and tachycardia, systolic murmurs and some distress on slight exertion. The hyperthyroidism in these cases is liable to be overlooked.

Organic Heart Disease in Pregnancy By far the most common valvular lesion met with in pregnancy is *mitral stenosis*. In University College Hospital the relative frequency was as follows: *Mitral stenosis*, 86 per cent, *mitral stenosis with aortic regurgitation* 10 per cent, *aortic regurgitation*, 15 per cent, *paroxysmal tachycardia* 2 per cent. 18.3 per cent of these had congestive failure of such degree that there were persistent rales in the chest, enlargement of the liver, œdema, and pulsation of the veins of the neck. It is important to bear in mind that valvular disease is not the only cardiac lesion that may cause trouble. Thus apart from any valvular disease, *myocarditis* and *degeneration of the*

heart muscle may occur by itself and be a serious source of danger and *acute or subacute toxic endocarditis* may be engrafted on a chronic valvular lesion during pregnancy or the puerperium. This is especially liable to occur when the valvular lesion is of recent origin, and if the last attack of rheumatic fever has occurred shortly before the commencement of pregnancy.

Paroxysmal tachycardia though fairly common at other times and liable to be aggravated during menstruation is rare in pregnancy. The attacks in those subject to them may cease entirely during pregnancy and reappear in the puerperium.

Ætiology There is usually a history of rheumatism growing pains tonsillitis or chorea. One or more of these was found in 81 of the 100 consecutive cases observed by Kenneth Harris in the Obstetric Unit University College Hospital. The remaining 19 cases gave no history of previous rheumatic fever chorea growing pains or tonsillitis.

Signs of Cardiac Failure in Pregnancy Following Price's classification four degrees of cardiac failure may be recognised.

(1) *Slight* There is some shortness of breath palpitation exhaustion and perhaps precordial pain on exertion.

(2) *Moderate* There are shortness of breath palpitation cyanosis on moderate exertion e.g. walking on the level some increase in pulse rate while at rest and slight enlargement of the liver. There may be fine crepitations at the bases of the lungs and these patients as well as those suffering from the more severe degrees of cardiac failure seem particularly prone to develop bronchitis.

(3) *Severe* There are shortness of breath on slight exertion cyanosis while at rest severe œdema of the lower extremities in mitral cases and a moderate degree in uncomplicated aortic cases. There may be tachycardia while at rest œdema of the bases of the lungs hepatic enlargement albuminuria and orthopnoea.

(4) *Extreme* All the signs mentioned above are more marked and in addition there may be effusion into the serous cavities much hepatic enlargement severe tachycardia and tic tac heart beat and fetal rhythm. In the more severe degrees pulmonary infarction and hæmoptysis are not infrequent.

The signs of failure above described may be present before pregnancy starts may appear for the first time in the early months of pregnancy or may be delayed till the later weeks. As

we shall see later, the time when failure first sets in has a very important bearing on treatment

Prognosis It is generally agreed that the two most dangerous valvular lesions in pregnancy are aortic incompetence and mitral stenosis, and of these two the former, though comparatively rare is probably the more serious. According to Mackenzie, if in this form of valvular disease the enlargement of the heart is slight or absent, if there is no water hammer pulse, and the response to effort is good, the outlook is favourable. If, on the other hand there is a forcible apex beat outside the nipple line a marked water hammer pulse, and a distinct limitation of the response to effort, then pregnancy is undesirable and dangerous. Kenneth Harris found that there was no difference in prognosis between cases with mitral stenosis and those with aortic regurgitation or those in whom both these lesions were present.

In mitral stenosis the outlook is usually regarded as depending on (a) the amount of narrowing at the mitral orifice and (b) the condition of the heart muscle as shown by the response to effort. If the constriction of the orifice is slight, as is indicated by the presence of a pre-systolic murmur alone, and if the response to effort is good, then the outlook is favourable, and pregnancy is not likely to be attended by much danger. If, on the other hand, the constriction is severe, as shown by the presence of a diastolic as well as a presystolic mitral murmur, and especially if the response to effort is unsatisfactory, the prognosis is unfavourable and such a patient should not be allowed to undergo the strain of pregnancy. The marked degree of constriction at the mitral orifice throws undue strain on the left auricle, which the latter is unable to meet unless its muscle is in a healthy condition. The auricle then dilates and venous stasis occurs in the lungs, which become congested and cedematous, excessive strain is thus thrown on the right ventricle and auricle which dilate in their turn and all the classical signs of 'back pressure' appear. Finally, auricular fibrillation sets in shown clinically by distress and dyspnoea, by disappearance of the presystolic murmur, and by the pulse becoming rapid and completely irregular, both in volume and rhythm.

It is thus impossible to stress too much the importance of the condition of the heart muscle in estimating the outlook in all forms of heart disease in pregnancy. For while the actual valvular lesion is important in that it forms a mechanical hindrance to the

work of the heart, yet on the muscle ultimately falls the task of maintaining the circulation. As valvular disease rarely if ever exists by itself, but is accompanied by more or less myofibrosis—an extension into the muscle of the fibrosis of the valves and orifices—the muscular walls of the heart may be much less efficient than normal and quite unfit to maintain the circulation against the mechanical obstacles imposed by valvular lesions. Of the condition of the heart muscle the response of the patient to effort is, of course, the best measure.

Kenneth Harris attaches great importance in prognosis to exercise tolerance, and concludes that (1) early breakdown of exercise tolerance in a primigravida is a grave sign accordingly a careful investigation of the history of the patient's exercise tolerance during the early months of her pregnancy is of great value, and (2) in multiparæ the experience derived from the previous pregnancies is of great value since the breakdown of exercise tolerance earlier and earlier in each successive pregnancy is a serious feature.

Jensen states that as the myofibrosis is more advanced in old standing valvular disease, so in this the outlook is more unfavourable because of the greater liability to muscular failure. On the other hand, in the recently established cases and especially if the pregnancy has been recently preceded by an attack of acute rheumatism, there is a great liability to acute or subacute endocarditis.

Hunt, after a study of 156 cases, lays great stress in prognosis on the size of the heart, and concludes as follows:

(1) Provided the heart is not enlarged patients with mitral stenosis stand pregnancy well, and there is not much extra risk.

(2) If the heart is enlarged the risk is increased and it does not matter much whether the valvular disease is aortic regurgitation or mitral stenosis. The amount of extra risk depends on the degree of enlargement, and the treatment that can be adopted during pregnancy.

(3) In auricular fibrillation the results are so disastrous that pregnancy should be prohibited.

To sum up therefore regarding prognosis, it may be said that *provided there is only slight or moderate enlargement of the heart, if exercise tolerance is good and there is no congestive failure the outlook is favourable. Should failure set in, the period of pregnancy when it first appears, its severity and the response to treatment are all*

important The earlier in pregnancy congestive failure appears, the less, obviously, is the reserve force of the heart, and the worse is the prognosis

The Incidence of Premature Labour This is high in cardiac cases In the series observed in the Obstetric Unit, University College Hospital, by Kenneth Harris it was 16.5 per cent in the whole series of 100 cases and was much higher in those who had congestive failure (42.9 per cent) than in those who had not (14.6 per cent)

The Remote Prognosis Even after pregnancy and labour are safely passed it is often found that a certain amount of permanent heart weakness is left, which is shown by diminished exercise tolerance as compared with that present before pregnancy Of six cases of auricular fibrillation during pregnancy observed by Mackenzie, all with mitral stenosis following rheumatic fever, though all lived through the confinement, none ever recovered the same degree of health as was present before the pregnancy, and five gradually became worse and died within two years Jensen found that out of forty nine patients, in 40 per cent of whom there were dangerous symptoms during pregnancy, thirty five were as well as before pregnancy, eleven had become worse and two had died from their heart disease and one from eclampsia These good results had only been obtained, he considers, by "close observation and rational treatment during pregnancy and for a long time post partum"

Kenneth Harris gives the following result of his "follow up" of 100 consecutive cases of heart disease with normal rhythm that he had observed in the Obstetric Unit, University College Hospital Twenty of the patients subsequently became pregnant again whilst under observation

TABLE VI Showing Late Results in a Series of 100 Cases of Heart Disease with Normal Rhythm in Pregnancy (Kenneth Harris)

	Total (100)	At 2 years	At 4 years
Free of symptoms	11*	10	0
Unchanged	37†	25	10
Worse	38	28	10
Dead	14	12	2

* Includes 1 lost sight of at 1½ years

† Includes 2 lost sight of at 1 year and at 1½ years

It will be seen that just over 50 per cent of the whole series were worse or dead at the end of four years

Treatment. (1) *In the Antenatal Period* The management of pregnant patients with heart disease must always be a matter of anxiety. All cases, no matter what the condition of the heart muscle, should be carefully watched throughout the pregnancy, and the amount of physical strain regulated so that it is well within the patient's capacity. A moderate amount of exercise is beneficial, with fresh air and nourishing food. If there is anæmia a non irritating preparation of iron should be given. The patient should be guarded as far as possible against chills, dampness and infections, and special attention should be devoted to the care of the skin, kidneys and alimentary canal. The tendency to bronchitis should be kept in mind, and early treatment instituted should it arise. If there has been a recent attack of rheumatic fever, the possibility of fresh attacks of endocarditis should not be overlooked. According to Jensen this is the greatest danger that threatens all patients with heart disease in pregnancy, and it developed in 20 per cent of his cases. It develops slowly and insidiously, with its usual symptoms, the most important of which are tachycardia at rest, dyspnoea, and slight fever and, it may be, œdema, anæmia and albuminuria. Its onset may be due to diminished resistance to a latent infection.

Should signs of congestive failure appear the patient should be put to bed. The rest thus obtained is often enough to allow the restoration of the lost balance. Fluids should be restricted and such conditions as constipation, flatulence, bronchitis or sleeplessness should be suitably treated, but drugs of the digitalis group are not usually satisfactory unless there is auricular fibrillation. Tincture of digitalis should then be administered in doses of 10-15 minims three daily. Overdosage is shown by the production of nausea, vomiting, a feeling of pain and constriction across the chest or undue slowing of the pulse. If any of these symptoms appear the drug should be at once stopped. It should never be pushed farther than is necessary to slow the pulse to 60 or 70, and when that has been done it may be stopped temporarily, only to be resumed when the rate again begins to increase. In some cases of auricular fibrillation benefit may be obtained from the use, in addition to digitalis, and especially when the latter fails to restore the normal rhythm, of quinidine sulphate in small doses, starting with 0.2 grams by the mouth, and after two or three doses increas-

ing to 0.4 grams three or four times daily. Its use, however, is not without danger, and in some cases it fails altogether, or the restoration of the normal rhythm may be only temporary. It should never be given when congestive failure is well established, on account of the danger of detaching clots from the auricle. In cases in which the response to effort is rather poor, even though there are no definite signs of congestive failure, rest in bed for ten days before the expected date of delivery is of great value in preparing the patient for the strain of labour. This is all the more necessary if the abdomen is unduly large, as in twin pregnancy or hydramnios.

Failure in the Early Months of Pregnancy Should signs of failure appear during the early months of pregnancy, the patient should be restored as far as possible by rest and medical treatment, and as a rule, it is wise, especially if the breakdown has been at all serious, to terminate the pregnancy by induction of abortion or by abdominal hysterotomy, which has the great advantage that it renders possible sterilisation by excision of a part of each Fallopian tube. It is impossible, however, to do more than lay down a general rule. Each case must be considered on its own merits—the nature of the lesion, the degree of failure, the exact time when it sets in, the state of the heart muscle, the response to treatment, and last, but not least, the wishes of the patient must be given full consideration. The patient, for example, may have no children, and be willing to take the risk of carrying on till the child has reached viability. That this may sometimes be done is illustrated by one of Lennie's cases. The patient had been in bed since her last confinement three months previously, and was admitted to a general hospital with loss of compensation, after a few months she was found to be pregnant and was transferred to the maternity hospital. On compensation being regained she insisted on leaving the hospital, only to return a month later with recurrence of breakdown. She was ultimately sectioned and sterilised, and was dismissed well with a live child. Prior to that she had been confined to bed for a year. It should, however, be clearly understood that in such a procedure there is a definite risk, and even when a viable child is obtained it is usually at the expense of a considerable shortening of the patient's expectation of life.

Perhaps in no disease complicating pregnancy is constant consultation and co-operation between the physician and the

obstetrician so essential, and fraught with such advantage to the patient. Such co-operation can best be obtained under hospital conditions and many more beds could be utilised for the care of these patients than are at present available.

Failure in the later Months of Pregnancy In this case it is usually best to rely on medical treatment and to allow labour to come on spontaneously. Fortunately, such patients tend to go into labour somewhat prematurely, or at least not to go beyond term.

The Question of Induction of Premature Labour When congestive failure has occurred in the later months of pregnancy the question of induction of premature labour may come up for consideration after compensation has been restored. It may be said at once that induction of labour by bougies or by any other method involving the use of a general anæsthetic is inadvisable. Lennie considers the operation disastrous. In his series the death rate among patients induced by bougies was 44 per cent, and Jardine wrote, in 1901 "The results from (instrumental) induction are so bad that I am inclined to question the propriety of doing the operation. The risk is exceedingly great." Induction of labour by rupture of the membranes is not, however, open to the same objections. The operation is easily performed without distressing the patient, no anæsthetic is required, and provided the head is engaged in the pelvis we are now inclined to favour this procedure after compensation has been fully re-established and provided the pregnancy has passed the end of the 36th week. The patient is thereby saved the strain of the last week or two of pregnancy. As an alternative Cæsarean section may be considered but it is usually unnecessary for these patients generally stand labour remarkably well and the labour is usually easy. In our opinion *Cæsarean section should never be carried out merely to permit sterilisation at the same time*. It is much better practice in most cases to allow the patient to go through labour *per vias naturales* and then if sterilisation is considered advisable, to carry it out at the end of the third week of the puerperium. Cæsarean section even in the most favourable circumstances, is followed by a 2 per cent mortality, and this is too high to justify its performance merely for the sake of sterilisation. There may be, of course, occasional cases in which it is considered inadvisable to allow the patient to undergo the strain of labour and Cæsarean section may then be necessary, but

these are rare. Responsibility for the decision regarding the method of delivery, and the time for interference, if this be decided upon, should always be shared with the cardiologist. It is only by such co-operation that the best results can be obtained.

Persistence of Congestive Failure in Spite of Medical Treatment
In such cases, which are fortunately rare, it is usually best, when the maximum degree of improvement has been obtained, to terminate the pregnancy either by Cæsarean section or by rupture of the membranes. This should, in the interests of the child, be delayed if possible, till at least the end of the 36th week, but in choosing the time the well being of the mother must be the first consideration.

(2) *Management during Labour* The first stage should be conducted much as in normal cases. The chief danger is exhaustion from loss of sleep when the first stage is very prolonged, and this may be prevented by a draught containing sodium bromide grains 25 chloral hydrate grains 25, tincture of opium minims 8. Nourishment should be given at regular intervals. Especially valuable is glucose one heaped tablespoonful to one pint of water flavoured with lemon and the patient may drink as much of this as she wishes. If there is hydræmia sufficient to embarrass respiration, the membranes should be ruptured.

The Second Stage is a period of dangerous strain to a patient with an embarrassed heart, because the rise in blood pressure during the strong expulsive efforts may lead to acute dilatation of the heart. It is usually best to have the patient on her back in a semi-recumbent posture, and she may maintain this position until delivery. To prevent strong down-bearing efforts, a general anæsthetic should be given, preferably gas and oxygen, but if this is not available, chloroform given by the intermittent method is preferable to ether because of the liability of the latter to cause pulmonary complications. If there is much distress and any indication for haste, as soon as the os is fully dilated and the head in the pelvic cavity, forceps should be applied. In most cases, however, they are unnecessary, and their routine application in the absence of definite indications, such as maternal or foetal distress, is to be condemned. In University College Hospital the forceps rate in heart cases during the last eight years has been considerably under 5 per cent, and no greater than the forceps rate for the hospital as a whole. The administration of oxygen may give much relief if there is distress or cyanosis.

The Third Stage In this stage there is great danger of collapse and death. The reason for this is not clear. It may be that the sudden lowering of blood pressure after the delivery of the child leads to pulmonary embolism. Many obstetricians therefore place a sand bag on the abdomen as soon as the child is born. Miles Phillips advises the application of a thick pad and binder to the upper abdomen. He considers that the rapid emptying of the uterus by Cæsarean section in cardiac disease is particularly dangerous especially if the heart lesion is insufficiently compensated. "The woman may die from the Cæsarean section and not in spite of it."

Personally, I find it a wise and comforting precaution to have an assistant ready to apply pressure on the epigastrium with a sterilized warm double cloth during and for some time after the rapid evacuation of the uterus in certain cases of Cæsarean section. According to Berry Hart, the sudden death is due to the blood from the placental sinuses and from the uterine sinuses after the placenta has been removed and the uterus has retracted, being thrown suddenly into the systemic circulation. This distends and paralyses the right auricle so that the right ventricle is not filled. Hence no blood passes into the pulmonary circulation, and therefore none into the left side of the heart. The left ventricle then during systole has no blood to propel into the general circulation, and acute *anæmia of the brain results, with syncope*. It is therefore advisable to allow the placenta to take plenty of time to separate, and a little post-partum hæmorrhage should be encouraged. It is said that there is a special danger of excessive post partum hæmorrhage in cardiac cases, but at University College Hospital we have not seen any evidence of this.

Anæsthesia during Labour in Cardiac Cases The best general anæsthetic is nitrous oxide gas and oxygen but if this is not available, chloroform or the A C E mixture is preferable to ether, on account of the liability of the latter to cause pulmonary complications. Good results have recently been obtained by the use of cyclopropane, C_3N_2 , 20 per cent, with oxygen, 80 per cent. It does not irritate the lungs, gives good relaxation and can safely be administered for any reasonable length of time. It goes without saying that the help of a colleague, and if possible an expert anæsthetist, should always be obtained. This should be done in all operative deliveries, but in those with heart disease the need is absolute. It is said that general anæsthetics are very

safe in the second stage of labour but this immunity certainly does not extend into the third stage when indeed they are particularly dangerous and should if possible be avoided especially if the patient is shocked or the blood pressure low. Should perineal repair be necessary it may be carried out painlessly and with perfect safety after the placenta has separated by infiltrating the damaged area with a solution of novocaine 2 per cent to which is added adrenalin chloride (1 in 1000) in the proportion of 1 minim to each dram of novocaine. For Cæsarean section local anæsthesia is best of all. If a general anæsthetic is necessary nitrous oxide gas and oxygen or cyclopropane and oxygen is again preferable to ether or chloroform. It may be found necessary to anæsthetise the patient in the semi-recumbent position but once under the anæsthetic she can usually lie down without respiratory embarrassment.

(3) *Management after Labour* It is generally advisable especially if there has been much congestive failure to keep the patient in bed for at least three weeks in order to allow complete recovery of the lost compensation. In the milder degrees breast feeding may be allowed but if there has been much failure it is usually inadvisable. Here again however it is impossible to formulate a hard and fast rule. Breast feeding may cause less fatigue than the preparation of artificial mixtures and each case must be judged on its merits. Munro Kerr and others have referred to the danger of death in cardiac cases on the 4th or 5th day of the puerperium. Its cause is unknown but it is not unlikely that a latent endocarditis or myocarditis is stirred up either by a mild infection or by the absorption of toxic products of degeneration of the uterine muscle or decidua.

The Question of Further Pregnancies If another pregnancy is desired an interval of two or three years at least should usually be insisted on. If the patient already has two or three children it is better to advise against another pregnancy for not only is it likely to damage the heart muscle still farther and so shorten the expectation of life but the strain of rearing a large family may seriously deplete the patient's strength. To prevent pregnancy contraceptive measures may be sufficient especially if the patient is approaching the menopause. They are however usually too unreliable and this is the case especially among patients of the hospital class. It is therefore in most cases better to have recourse to surgical sterilisation by resection of the inner

portion of each Fallopian tube As pointed out above, this is best done at the end of the 3rd week of the puerperium, before the patient leaves hospital

Varicose Veins

About 20 per cent of pregnant women suffer more or less from varicose veins They are much more frequent in multiparæ (80 per cent) than in primiparæ (20 per cent) and certain families seem to be predisposed to them They often start as early in pregnancy as the 2nd month, and therefore at a time when pressure cannot play any part in their production Multiparæ, indeed, may sometimes obtain the first intimation of pregnancy from the feeling that the veins have begun to enlarge An obvious explanation of this early onset is the increased vascularity of the pelvic organs, which leads to turgescence of all the tributary veins of the pelvis, and possibly an accessory cause is the generalised atony of unstriated muscle including that of the veins, which there is reason to believe is one of the physiological attributes of pregnancy

In the treatment of this condition it is important to wear suspenders in place of garters, which constrict the limbs The sufferer should spend a good deal of time lying on her back with the feet on a level with the body, or even higher, and the clothes loosened around the waist If it is impossible to spare time for prolonged rest much relief may be quickly obtained by lying flat on a bed or couch, and raising the feet with the legs stretched straight out almost at right angles with the trunk, supporting the feet against a wall or other convenient support. If this position can be adopted for five or ten minutes three or four times daily, it will do much to reduce the size of the veins and relieve the pain

In addition to the foregoing measures, it is often advisable to wear a support of some kind A bandage made of elastic webbing is probably best of all—3 inches wide and about 3 yards long This is better than a bandage of pure rubber It should be applied in the morning immediately after rising, worn all day and removed at night In applying it, one or two turns should first of all be wound around the foot, then on to the ankle, and thence spirally up the leg as far as required, which is a little above the highest varicose vein It should be applied firmly, but not too tightly, and each turn of the bandage should overlap the one

immediately below by about an inch. It is best to take off the bandage during the elevation of the leg above described, and reapply it afterwards, as it gets slack after the leg has been elevated for some time. Varicose veins of the vulva are also much relieved by rest—lying flat on the back or side, and if the hips can be raised above the level of the rest of the body so much the better.

Treatment by Injection Within the last few years it has been shown by Kilbourn, Ritchie and others that the treatment of varicose veins, whether in the legs or vulva, during pregnancy is a safe and effective procedure. Alison Ritchie has treated 50 cases by this method in the Edinburgh clinic with most satisfactory results. The substance used was a 5 per cent solution of sodium morrhuate—the sodium salt of a fatty acid obtained from cod liver oil. The technique employed is as follows: a minim syringe which has been lying overnight in methylated spirit, and is then well washed in sterile water, is used. In loading it, a large-bore needle is used, as the solution is viscid. Prior to injection, this needle is replaced by a fine needle, size 15 or 16, with a short bevel, or by one with a sharp but solid point, with a hole connecting with the bore of the needle just proximal to the point. For the injection of the vulvar varicose veins the patient lies on her back in the supine position. The part to be injected is not shaved, but swabbed with biniodide of mercury solution. The most prominent portion of the vein is selected, whether over the outer or the inner surfaces of the labia majora. The needle is inserted, the piston of the syringe withdrawn to make sure of entry into the vein, and 1 to 2 c.c. of sodium morrhuate injected. As much as 5 c.c. of the solution is sometimes injected at one sitting. Where possible, the finger and thumb of an assistant are placed at either visible end of the vein for about two minutes, to keep the sodium morrhuate in contact with the endothelial lining of the vessel as long as possible. The clot usually forms almost at once, and is the result of a momentary severe local chemical reaction on the endothelium at the site of injection. When the legs are injected the patient either sits or stands, often on a chair to ensure easy access. No tourniquet is used, but the injection is directed centrifugally as far as possible. The patients are told to report a week later, and almost always it is found that satisfactory clots have formed, while in the course of a few weeks the fibrosed veins become gradually impalpable. The majority of the patients have no symptoms at all after injection, but a few complain of pain

and stiffness, which usually disappears after a day or two. *Sodium morrhuate* has the great advantage over *quinine urethane*, which has been used by Greene and others, that if any of the material is spilled into the tissues around the vein it has no tendency to cause necrosis.

Phlebitis in Pregnancy

This is a rare complication of pregnancy. Goldsborough, in 1904 could only collect 10 cases from the literature. In University College Hospital we had 3 cases in 10 years, i.e. in about 12,000 booked patients. The patient is usually a multipara and there is often a history of phlebitis in a previous puerperium. Not infrequently the swelling of the leg has persisted in the interval. Again varicose veins predispose to it and then the phlebitis is usually in the superficial and visible varicose veins and does not therefore cause much swelling of the leg. It may, however, start for the first time in pregnancy and in an apparently normal patient, and affect the iliac, femoral or saphenous veins usually of one side. In these cases the cause is often obscure though anæmia seems to predispose to it, and a septic focus in teeth, tonsils, intestine, or elsewhere from which organisms enter the blood stream may be suspected. Goldsborough records a case in which the patient was admitted to hospital with nausea and vomiting and great swelling of the left leg and thigh. As the condition deteriorated rapidly, labour was induced by a hydrostatic bag, but the patient died soon after delivery. At post mortem examination the left common iliac vein was found occluded by a clot, which started where the vein was crossed by the right common iliac artery, and extended to the femoral and saphenous veins. The patient had been tight lacing in order to conceal her pregnancy, and it was believed that in this way the uterus was pressed back against the vertebral column and compressed the structures between the compression of the vein being naturally most marked at the point where it was crossed by the artery. A clot formed at this point and gradually extended downwards.

Phlebitis has usually no effect on pregnancy apart from the pain and inconvenience caused by the swelling and the necessary immobilisation; neither is there any special predisposition to the development of phlegmasia in the puerperium. The treatment is rest in bed and immobilisation of the limb until all pain and

swelling have disappeared. After the acute stage has passed massage will help to disperse the œdema.

Purpura Hæmorrhagica

This too is a rare complication of pregnancy. Rushmore, in 1925 reported 1 case and could only find 47 others recorded in the literature. Occasionally the disease may be present before pregnancy as in a case reported by Glvn Morgan, in which the patient a primigravida had had the condition on and off for fourteen years (accompanied by excessive menses) before pregnancy began. Usually the disease starts in a previously healthy multipara about the 6th or 7th month and is characterised by slight preliminary malaise with headache and pyrexia followed by the appearance of petechial spots and ecchymoses all over the body and limbs together with bleeding from the gums epistaxis, hæmatemesis hæmorrhage from the rectum and sometimes from the urinary tract. After a time the patient becomes profoundly anæmic with fever weakness rapid pulse and dyspnoea and there may be marked albuminuria and œdema probably the result of the anæmia but the blood pressure is not raised. Of the 44 patients in Rushmore's series in whom the end results could be ascertained 26 died and 18 recovered while of the 42 infants traced 27 died and 15 recovered. In 7 cases the child was also affected. It may be born with the disease or develop it a few hours or a few days after birth. Like the mother it shows petechial spots and ecchymoses hæmorrhage from mucous surfaces and sometimes there may be cephalhæmatoma. As to the cause of the disease little is known. The blood platelets are much diminished in number from the normal 300 000 per cubic millimetre to 5 000 or less and this is probably the cause of the bleeding. The diminution in the platelets is usually ascribed to a toxin in the maternal circulation but its source is unknown. The resemblance of the disease to scurvy which is due to deficiency of vitamin C, should be kept in mind in both the gums may be spongy and bleed readily. Apparently the toxin can pass through the placenta and affect the foetus. In many cases there is an abnormal permeability or fragility of the capillaries which is now believed to be due to deficiency of the permeability vitamin P. This vitamin often occurs in nature in association with vitamin C (hips lemon juice) so that there may be a deficiency of both. Premature labour often comes on after which recovery may take place.

gradually but steadily; but even after delivery many patients go down hill, become prostrated and delirious, and die within a few hours or days. It is remarkable that there does not seem to be much tendency to post partum hæmorrhage.

Treatment Rest is important with nourishing diet and anti-scorbutics. Calcium lactate and iron may be given, and are sometimes effective. Usually, however, blood transfusion is necessary and it may be repeated. It arrests the disease at least for a time, probably by increasing the blood platelets, and when temporary improvement is obtained it may be advisable to induce labour. For the child, 5-10 c c of hæmoplastin may be tried, but probably blood transfusion is best—10 c c of the father's blood being injected into the subcutaneous tissues beneath the scapula, or of the abdominal wall. Vitamin P should be administered by the mouth or by hypodermic injection and should be combined with vitamin C. The optimum dose has not yet been determined with certainty, but it is said that a proportion of one part of vitamin P to 5 parts of vitamin C gives good results.

REFERENCES

- GAMMELTOFT, S. A. *SGO*, 1928 46 382
 GOLDSBOROUGH, F. C. *Bull Johns Hopkins Hosp* 1904 15, 103
 HARRIS IRENEATH *Lancet* 1937, i 677
 HART, D. BERRY *Guide to Midwifery* Heinemann London 1912
 HART, D. BERRY "Selected Papers in Gynecology and Obstetrics" W and A K Johnston, 1903 191
 HUNT, G. H. *Guy's Hosp Rep*, 1926 6, 135
 JARDINE, R. *Jour Obst and Gyn Brit Emp*, 1902 1 389
 JENSEN G. *Acta Gyn Scand*, 1927, 6, 239
 KERR J. M. MUNRO *Brit Med Jour* 1927 ii, 245
 KILBOURNE, N. J. *Am Jour Obst and Gyn*, 1933 25, 104
 LEVINE, R. A. *Jour Obst and Gyn Brit Emp*, 1927, 34 331
 MACKENZIE, SIR JAMES *Heart Disease in Pregnancy* Henry Frowde, London 1921
 MORGAN, G. *Jour Obst and Gyn Brit Emp* 1923 30 438
 PHILLIPS MILES H. *Trans Amer Assoc of Obstetricians Gynecologists and Abdominal Surgeons* 1930, 14
 PRICE F. W. *Brit Med Jour*, 1926 ii 242
 RITCHIE ALISON *Trans Fdin Obst Soc*, 1933, 53 157
 RUSHMORE S. *Am Jour Obst and Gyn*, 1925 10, 553
 SEITZ L. *Verhand d deutsch Gesellschaft f Gynak*, 1913-14 15, 213

CHAPTER XXIV

DISEASES OF THE CIRCULATORY SYSTEM—(continued)

The Anæmias of Pregnancy

THOUGH severe anæmia is, at least in this country, a comparatively rare complication of pregnancy, it may be serious enough in its results to make it essential for the medical attendant to recognise it promptly and deal with it efficiently. Anæmias of the mild and secondary type are quite common, but are often overlooked, because they tend to be overshadowed by the more immediately engrossing and perhaps, alarming causal condition such as pyelo nephritis, pregnancy toxæmia etc.

The anæmias met with in pregnancy may be classified as follows

(1) The ' physiological anæmia of pregnancy ' In this there is no qualitative abnormality of the cells or hæmoglobin but both appear to be decreased equally

(2) Anæmia due to iron-deficiency

(a) Existing before pregnancy

(b) Arising from or exaggerated by pregnancy (possibly)

(c) Due to hæmorrhage during pregnancy (*v seq*)

In these the anæmia is due chiefly to a deficiency of hæmoglobin. The red blood corpuscles may or may not be diminished in number and may be smaller than normal (*i e*, microcytic) and the colour index is below 1, hypochromia is marked. They respond to treatment with iron.

(3) Anæmia due to lack of the "P.A. factor" (Vaughan)

(a) Addisonian anæmia existing before pregnancy

(b) Severe anæmia of pregnancy (possibly)

(c) Tropical macrocytic anæmia

In these the mean size of the red cells is above normal (macrocytosis) and the colour index is above 1. They do not respond to treatment with iron alone.

(4) Aplastic anæmia

The cells are normal or rather above normal in size. The bone marrow may not be entirely aplastic but no treatment other than blood transfusion benefits these cases.

(5) Anæmia secondary to other diseases

- (a) Diseases of pregnancy, *e g.* pyelitis, pregnancy toxæmia
- (b) Pre existing diseases, *e g.* tuberculosis, chronic nephritis
- (c) Due to lead poisoning (used as an abortifacient)
- (d) Leukæmia (leuko erythroblastic anæmia)
- (e) Banti's disease, etc

(6) Anæmia due to hæmorrhage during pregnancy

- (a) Immediate
- (b) Remote (due to iron deficiency, *v ante*)

The "Physiological Anæmia" of Pregnancy An increase in the blood volume has been shown to occur during pregnancy (Dieckmann and Wegner, Richter) This increase occurs in the majority of (but not in all) patients, it begins at about the 12th week and reaches a maximum shortly before delivery After this the blood volume falls and regains the normal level within four weeks of delivery It is impossible to demonstrate that this increase fulfils any useful purpose but it may be due to the increase in the capacity of the vascular system which occurs in connection with the growth of the uterus and placenta

This increase in the volume of the circulating fluid is mainly, if not entirely, in the blood plasma As a result there is a dilution of the cells and an apparent "anæmia" In a series from which cases of true anæmia and other abnormalities were excluded Boycott found that the maximum dilution occurred at 32-33 weeks Some cases do not show this dilution of the red cells at any time

The name "physiological anæmia of pregnancy" has some historic interest but should now be abandoned for "physiological hydræmia of pregnancy" As will be apparent, this hydræmia can and does coexist with the true anæmias in pregnancy

Iron-deficiency Anæmias Many series of examinations of pregnant women made during recent years have established that some degree of anæmia is relatively common and that the great majority of cases respond to iron therapy. As in most cases there has been no attempt to distinguish a true anæmia from an apparent anæmia due to hydræmia it is not surprising that the response to iron has seemed in some cases to be incomplete or irregular

Boycott, amongst 222 unselected patients attending the antenatal clinic at University College Hospital, London, found that 78 per cent always had hæmoglobin over 80 per cent (Haldane), 22 per cent had hæmoglobin less than 80 per cent, on at least one occasion and in 11 per cent it was less than 70 per cent. Davies and Shelley in London, and Balfour and Drury on Tyneside found an incidence of the same order. Jerlov (Denmark, 1925) Esch (Germany) Adamson and Smith (Canada) and Adair (U.S.A.) all found approximately the same figures. Richter found a higher incidence among white and black patients in U.S.A. but he noted a low standard of general health among the group examined. Fullerton at Aberdeen also found more anæmic pregnant women among a population in which the incidence of anæmia due to iron-deficiency was remarkably high.

Two views on the ætiology of the anæmia occurring in pregnancy have gained support. Strauss (1934) distinguished clearly between the hydremia of pregnancy and hypochromic anæmia. In the latter he found that more than half the cases showed a marked decrease or absence of free hydrochloric acid in the gastric juice with a return to normal following delivery, and the degree of anæmia corresponded to the decrease in hydrochloric acid. In the most severe cases the diet had been deficient in iron and other mineral elements and protein. A tendency to achlorhydria has been observed to be common during pregnancy, possibly due to the increased activity of the thyroid. It seemed from this that, while an insufficient iron intake would cause an anæmia, a similar state of affairs might arise from deficient absorption of iron due to the lack of acid in the gastric secretion. That this was possible was suggested by the observations of Kellogg and Vettier and others that iron was absorbed better from an acid medium. A deficient intake of iron, due either to a diet poor in iron or to deficient adsorption will fail to make good the foetal demands for iron which must occur in pregnancy. The new born child has five times the amount of iron per unit of body weight as compared with the adult and receives no appreciable amount in the milk. Strauss (1933) has shown that there is a correlation between the maternal hæmoglobin in pregnancy and the infant's hæmoglobin some months later: i.e. when the inherited iron store is exhausted. This would indicate that the foetal demands for iron will become apparent in the mother when her own supplies are insufficient.

Quantitative examination of this last hypothesis has led

Fullerton to another explanation of the occurrence of anæmia in pregnancy. He showed on the basis of an analysis of the amount of iron in the diets of the women whom he examined and the amount stored by the *fœtus* that the *fœtal demands* had been exaggerated and that they were insufficient to explain the severe degrees of anæmia which he encountered. Among the women in Aberdeen the incidence of anæmia rises from the age of 15-44 and then falls rapidly. Comparing the incidence in the same age groups in this period among pregnant and non pregnant women, he found that the degree of anæmia was in every case only slightly higher in the former, the difference is of the order to be expected from the dilution effect of the hydremia in pregnancy. The high incidence of anæmia among the large group which was examined (1,534 women of all ages) occurred almost entirely during the reproductive period of life and among a population whose iron intake was on the borderline of the minimum necessary for maintaining a positive iron balance. Davidson and Fullerton concluded therefore that anæmia during the reproductive period in women was due in the great majority of cases to the amount of iron in the diet being insufficient to balance the losses of menstruation. Anæmia in pregnancy they considered to have antedated pregnancy and to be exaggerated slightly by the hydremia. The iron demands of the *fœtus* and the losses at parturition do not appear to be a much greater cause of iron loss than normal menstruation over the period of pregnancy, age rather than multiparity is the reason for the higher incidence of anæmia among women who have borne many children. Hypochlorhydria they did not consider to be an ætiological factor of importance in the production of iron deficiency anæmia but rather to be due primarily to the same cause of long continued dietary defect.

In view of these reasoned quantitative arguments it does not seem permissible to regard the iron deficiency anæmia of pregnancy as a separate entity. The ætiology, clinical picture and treatment are identical with that of iron deficiency anæmia among women of the reproductive period.

Treatment The essential treatment is a sufficient quantity of iron in an assimilable form. Ferrous sulphate (gr. x daily) has been shown to be the most potent and the cheapest available source of iron, but Bland's pill (gr. 60 daily) and Ferri et Ammon Cit (gr. 90 daily) are both effective. Iron parenterally is not

Boycott amongst 222 unselected patients attending the antenatal clinic at University College Hospital, London, found that 78 per cent always had hæmoglobin over 80 per cent (Haldane) 22 per cent had hæmoglobin less than 80 per cent, on at least one occasion and in 11 per cent it was less than 70 per cent. Davies and Shelley in London and Balfour and Drury on Tyneside found an incidence of the same order. Jerlov (Denmark, 1925) Esch (Germany) Adamson and Smith (Canada) and Adair (U.S.A.) all found approximately the same figures. Richter found a higher incidence among white and black patients in U.S.A. but he noted a low standard of general health among the group examined. Fullerton at Aberdeen also found more anæmic pregnant women among a population in which the incidence of anæmia due to iron-deficiency was remarkably high.

Two views on the ætiology of the anæmia occurring in pregnancy have gained support. Strauss (1934) distinguished clearly between the hydræmia of pregnancy and hypochromic anæmia. In the latter he found that more than half the cases showed a marked decrease or absence of free hydrochloric acid in the gastric juice with a return to normal following delivery, and the degree of anæmia corresponded to the decrease in hydrochloric acid. In the most severe cases the diet had been deficient in iron and other mineral elements and protein. A tendency to achlorhydria has been observed to be common during pregnancy, possibly due to the increased activity of the thyroid. It seemed from this that while an insufficient iron intake would cause an anæmia a similar state of affairs might arise from deficient absorption of iron due to the lack of acid in the gastric secretion. That this was possible was suggested by the observations of Kellogg and Mettier and others that iron was absorbed better from an acid medium. A deficient intake of iron due either to a diet poor in iron or to deficient adsorption will fail to make good the foetal demands for iron which must occur in pregnancy. The new born child has five times the amount of iron per unit of body weight as compared with the adult and receives no appreciable amount in the milk. Strauss (1933) has shown that there is a correlation between the maternal hæmoglobin in pregnancy and the infant's hæmoglobin some months later: *i.e.* when the inherited iron store is exhausted. This would indicate that the foetal demands for iron will become apparent in the mother when her own supplies are insufficient.

Quantitative examination of this last hypothesis has led

Fullerton to another explanation of the occurrence of anæmia in pregnancy. He showed on the basis of an analysis of the amount of iron in the diets of the women whom he examined and the amount stored by the fœtus that the fœtal demands had been exaggerated and that they were insufficient to explain the severe degrees of anæmia which he encountered. Among the women in Aberdeen the incidence of anæmia rises from the age of 15-44 and then falls rapidly. Comparing the incidence in the same age groups in this period among pregnant and non pregnant women he found that the degree of anæmia was in every case only slightly higher in the former. The difference is of the order to be expected from the dilution effect of the hydræmia in pregnancy. The high incidence of anæmia among the large group which was examined (1534 women of all ages) occurred almost entirely during the reproductive period of life and among a population whose iron intake was on the borderline of the minimum necessary for maintaining a positive iron balance. Davidson and Fullerton concluded therefore that anæmia during the reproductive period in women was due in the great majority of cases to the amount of iron in the diet being insufficient to balance the losses of menstruation. Anæmia in pregnancy they considered to have antedated pregnancy and to be exaggerated slightly by the hydræmia. The iron demands of the fœtus and the losses at parturition do not appear to be a much greater cause of iron loss than normal menstruation over the period of pregnancy. Age rather than multiparity is the reason for the higher incidence of anæmia among women who have borne many children. Hypochlorhydria they did not consider to be an ætiological factor of importance in the production of iron deficiency anæmia but rather to be due primarily to the same cause of long continued dietary defect.

In view of these reasoned quantitative arguments it does not seem permissible to regard the iron-deficiency anæmia of pregnancy as a separate entity. The ætiology, clinical picture and treatment are identical with that of iron deficiency anæmia among women of the reproductive period.

Treatment. The essential treatment is a sufficient quantity of iron in an assimilable form. Ferrous sulphate (gr. x daily) has been shown to be the most potent and the cheapest available source of iron but Bland's pill (gr. 60 daily) and Ferri et Ammon Cit (gr. 90 daily) are both effective. Iron parenterally is not

advisable as it is both painful and less effective than when given by mouth. Hydrochloric acid has no demonstrable effect on the anæmia but is a stimulant to digestion and benefits some cases of "heartburn" during pregnancy. The diet should be as full and as varied as the patient's means allow.

It is desirable that every pregnant woman should submit to a hæmoglobin estimation at the end of the first trimester. Any case with a hæmoglobin value less than 90 per cent (Haldane) will benefit by iron treatment sufficient to raise the level above this limit. Any case with a value below 70 per cent must be considered as moderately anæmic and vigorous treatment pursued. It must not be forgotten that hydræmia seldom, if ever, lowers the apparent hæmoglobin below 75 per cent, cases with values above this may be irresponsive to iron therapy as the anæmia is merely an apparent one. The incidence of anæmia in Great Britain does not justify the administration of iron during pregnancy as a routine.

Anæmia due to lack of the "P.A. Factor" Osler, in a classical paper drew attention to the occurrence of severe anæmia as a cause of obstetric disaster. Since that time there have been several accounts of this condition as it occurs in temperate climates (Larrabee, Whitby), but few cases seem to have been investigated with the knowledge and methods of modern hæmatology. The cases have been noticed for the severity of the general symptoms produced and not for any uniformity in the blood changes, they include severe iron deficiency anæmia, Addisonian anæmia and the results of copious hæmorrhage. Nevertheless there is no doubt that occasionally a severe anæmia is found in association with pregnancy, which is not the result of iron deficiency or of any intercurrent disease. In an investigation of maternal deaths in Scotland Douglas and McKinlay attributed 19 out of 2,527 deaths to severe anæmia, the majority of these were known to be of the Addisonian type. Balfour mentions 1 case in 12,000 deliveries at the Rotunda, Dublin, 1 case in 1,800 at Queen Charlotte's Hospital and none in 1,600 at the Simpson Memorial Hospital. It is evident that in this country severe anæmia is a rarity. Balfour and McSwiney have called attention to the high incidence of a severe anæmia occurring in pregnancy in India. On hæmatological grounds it resembles Addisonian anæmia being macrocytic and responding to similar treatment, and it is associated with a high maternal and foetal mortality. Further investigation has shown that this anæmia is by no means limited in its incidence.

to pregnant women but is common among women kept in seclusion by the customs of the country and receiving an ill balanced vegetable diet (Wills and Mehta) Fairley has shown that an apparently similar anæmia is common in Macedonia

On the available data it is impossible to say if there exists a disease entity which deserves the title of pernicious anæmia of pregnancy Although cases of Addisonian anæmia becoming pregnant are not common (Wilkinson) there is no inherent reason why this should not happen and some of the cases of severe anæmia in this country may be explained on this basis without any definite evidence to the contrary There is a possibility that pregnancy may interfere with the secretion of the intrinsic factor so as to cause a temporary condition allied to Addisonian anæmia It is to be hoped that cases occurring in the future will receive thorough hæmatological investigation

The tropical macrocytic anæmia appears to be due to relative or complete absence of the P A factor (hæmatopoietin) due to lack of the extrinsic factor from the diet with or without deficient secretion of the intrinsic factor It is possible that this disease occurs as a rarity in this country

Diagnosis and Treatment An anæmia which develops slowly will not produce symptoms of dyspnœa until a low level of hæmoglobin has been reached These diseases are therefore insidious in onset and in the absence of a routine hæmoglobin examination may not be recognised until a catastrophe occurs Pallor icteric tinge and smooth tongue are all too common signs to call attention The resemblance to pregnancy toxæmia may be striking but the blood pressure is usually normal or low and there is no evidence of a failure of renal function Fever and diarrhœa may lead to a faulty diagnosis of some infection

Disaster will occur when the anæmia is so grave that the patient is unable to manage the severe exertions of late pregnancy and labour A blood count should reveal the true nature of the disease By the time the general symptoms are produced the hæmoglobin will probably be less than 30 per cent (Haldane) the red cells will be reduced in proportion or even more and the colour index will be unity or over

The treatment of the anæmia should be the administration of liver in some assimilable form Whole liver is better avoided as unpalatable Fluid liver extract (B P) in doses of $\frac{1}{2}$ oz to 2 oz daily or parenteral injections of sterile liver extract are the most

satisfactory, hog's stomach extract is also good, and both cheaper and more palatable than the liver extracts designed for oral administration. For the immediate treatment of a severe case of anæmia, liver extract given intramuscularly is the best method. Intravenous injection offers no appreciable advantage. The dose of liver extract should be a large one for the first two days (*e.g.* Campolon' 12 c.c. daily). When the improvement in the blood condition is obvious the dosage may be reduced and when a normal level of hæmoglobin is reached it is unnecessary to give more than will maintain that level, the amount varies greatly in different patients. Many cases are improved with the simultaneous administration of iron.

The indications for transfusion in the severe anæmia occurring in pregnancy must be the patient's pulse rate and blood pressure. If these indicate that the patient is severely shocked, transfusion with blood or saline must be begun as soon as possible. If there is no evidence of shock the effect of liver extract parenterally will be apparent very soon and transfusion is unnecessary.

Wills has shown that the tropical anæmia in India responds well to 'Marmite' as well as to liver.

Aplastic Anæmia Whitby has discussed the relation of this condition to pregnancy. It is fortunately rare. Two forms can be recognised. The first appears to be due to an individual susceptibility to the toxic action of some drugs (*e.g.* gold) on the bone marrow, it is often accompanied by agranulocytosis and thrombopenia. Although transfusion may be necessary the outlook is not grave if the implicated drug is withdrawn at once. The second type is idiopathic, a hypothetical "toxin" has been supposed. It is usually diagnosed as Addisonian anæmia but failure to respond to any treatment justifies its establishment as a separate disease entity. The only effective treatment is replacement therapy by repeated blood transfusion. The prognosis is almost hopeless.

Anæmia Secondary to other Diseases Some degree of anæmia is commonly associated with a number of common diseases (*e.g.*, tuberculosis, chronic nephritis, psoriasis). There is evidence that the more severe degrees of pregnancy toxæmia will produce anæmia. This "toxic" anæmia has been little studied. It is very seldom severe, the colour index is either normal or slightly below normal and the cells are of normal size. It is apparently due to inhibition of marrow function. Treatment is difficult and depends

in most cases on successful treatment of the primary disease, but the anæmia is seldom severe enough to be dangerous *per se*. Some cases are benefited by iron treatment.

The anæmia of lead poisoning is not often a severe one since the appearance of more dramatic symptoms will probably call attention to the intoxication before the anæmia becomes grave. It is distinguished by the large number of punctate basophile red cells in the circulation, in relation to a relatively slight degree of anæmia. Treatment is long and difficult and depends on encouraging the excretion of lead.

Leukæmia in Pregnancy Very few cases are recorded. Schroder, in 1899, described a case and found ten others in the literature, in only three of which was there evidence that the disease had existed before pregnancy. His patient a seven para who had suffered from the disease in her last pregnancy and possibly in all the others, had extreme abdominal distension at the 6th month due to the large spleen with superadded pregnancy, dyspnœa, extreme weakness, headaches, loss of appetite, and tinnitus aurium. Abortion was therefore induced. Herman reported a case in 1901 and could only find seven others recorded that would bear critical examination. His conclusions were as follows: (1) The splenic enlargement causes suffering from abdominal distension. (2) The leukæmia is aggravated by pregnancy. (3) There is a great tendency to abortion or premature labour. (4) Death sometimes follows quickly after termination of the pregnancy. (5) If the patient survived the termination of pregnancy improvement took place. Herman and Schroder agree that there is no special tendency to post partum hæmorrhage, and that the disease is not conveyed to the fœtus. Herman advises induction of abortion or premature labour if the symptoms are causing suffering, and are aggravated after the onset of pregnancy. Ohlsson, in 1925, described a case of his own and collected twelve others from the literature. In four of the cases abortion occurred, and interruption of pregnancy had often been followed by decided improvement. He agrees with Herman and Schroder that the disease is never conveyed to the fœtus. In his case sections of the placenta showed normal blood in the vessels of the chorionic villi and leukæmic blood in the intervillous spaces.

Banti's Disease (Splenic Anæmia) This is rare in pregnancy. Josephine Barnes (1910) reviewed seven cases from the literature.

and reported a further case. In this five hæmatemeses occurred in the first pregnancy and labour was complicated by post partum hæmorrhage. A second pregnancy was terminated at eleven weeks.

Experience from this case and from those reported in the literature seems to show that pregnancy aggravated the disease and as the uterus enlarges abdominal discomfort increases. Hæmatemesis epistaxis uterine hæmorrhage and progressive anæmia may all occur during pregnancy. Post partum hæmorrhage too may be excessive. Transfusion may be required because of the aggravation of the anæmia. Other symptoms should be treated as they arise and there is usually no need to terminate the pregnancy. The disease does not appear to be conveyed to the child. MacKenzie (1936) recorded a case in which splenectomy was performed at the 3rd month, a healthy child being born at term.

Anæmia Due to Hæmorrhage The consideration of this must be divided into two parts—the immediate loss of blood following a large hæmorrhage and the remote effect when the body is trying to make up this loss. Chronic hæmorrhage in its effects is more closely related to the second of these.

After a severe hæmorrhage the immediate response of the body is to make up the loss of blood volume and insure the filling of the right side of the heart. To this end a variety of mechanisms is brought into play—the spleen contracts (which brings with it an increase in the circulating cells) the peripheral vessels contract and the secretion of urine diminishes. Clinically the effect is noticeable in the thirst of which most patients complain after a hæmorrhage. The severity of the symptoms is determined, not only by the amount of blood lost but also by the rate of loss. The blood volume is made up to normal in from twenty-four to seventy-two hours after a severe hæmorrhage partly from the tissue fluids and partly from water absorbed from the intestine. It is at this time that transfusion of blood or saline is most valuable. The result will be an anæmia with a normal colour index. In trying to assess the amount of blood lost after hæmorrhage allowance must be made for these facts. Hæmoglobin estimations are of no value until the blood volume returns to normal—before that reliance must be placed on the pulse rate the blood pressure and the degree of shock. Estimation of the amount of blood lost on bed clothes almost always gives a too gloomy picture of things.

Following a transient leucocytosis the activity of the marrow increases to make up for the cells lost by hæmorrhage. The replacement of red cells proceeds faster than that of hæmoglobin and there is a consequent tendency for the colour index to fall temporarily. Complete replacement of the blood lost may be a matter of months following a severe hæmorrhage. The formation of hæmoglobin is encouraged by iron.

In a patient receiving a full and mixed diet this restoration of the blood to normal will proceed naturally. In those whose iron intake and reserves are inadequate the process of recovery from a severe hæmorrhage is a slow and incomplete one. The resulting condition is in fact indistinguishable from the iron deficiency anæmia of women in the reproductive period (*v. ante*). A chronic hæmorrhage (*e.g.* from hæmorrhoids) will produce the same condition even more effectively.

Treatment The treatment of acute hæmorrhage is dealt with in the chapter on Placenta Prævia. The treatment of the more remote effects is that of iron deficiency anæmia. All cases of hæmorrhage occurring in pregnancy (whatever the diet) should receive adequate dosage of iron to accelerate the return of the blood to normal. Repeated transfusion is to be deprecated in the treatment of post hæmorrhagic anæmia as tending to depress the natural activity of the marrow in response to the stimulus of the hæmorrhage.

The effect of Anæmia on Pregnancy and Labour There is no evidence that anæmia *per se* predisposes to complications in pregnancy when the hæmoglobin is above 50 per cent (Haldane) although some discomfort due to dyspnœa may be felt by patients at this level. Below this level there is undoubtedly a greater incidence of obstetric accidents than in normal patients but a large number of such anæmic patients suffer from some other complication of pregnancy (*e.g.* nephritis) to which their anæmia is due. Wickramasuriya in Ceylon from a large experience of patients suffering from hookworm disease (in which an iron deficiency anæmia due to chronic hæmorrhage occurs) found that in cases having less than 30 per cent hæmoglobin the incidence of serious accidents was very high, obstetric shock and post partum hæmorrhage were the chief complications, the degree of shock depending on the degree of anæmia. King also dealing with cases of hookworm disease, but in the U.S.A., considered that the anæmia alone was responsible for the prevalence of abortion and

premature labour. A hæmoglobin level of 30 per cent (Haldane) must then be taken as the limit below which a risk is involved in allowing a patient to reach the later months of pregnancy. Since many patients with this degree of anæmia do in fact have normal labours, in the case of an emergency it is probable that the wisest course of action is to be prepared to perform an immediate blood transfusion in case of an accident, rather than give a 'prophylactic' transfusion before labour. The effect of the transfusion in shock and post partum hæmorrhage depends at least as much on the volume of fluid given as on the supply of red cells and before such a catastrophe the patient is lacking the cells and hæmoglobin only. If however, the patient is seen some weeks before term these precautions should not be relaxed but massive iron therapy should be instituted in addition.

From a consideration of the incidence and severity of iron deficiency anæmia in pregnancy it is evident that obstetric accidents due to this cause will be rare. More commonly in this country the anæmias due to complicating disease, sometimes complicated by iron deficiency, will reach a level so low as to be dangerous. But in cases of tropical macrocytic anæmia obstetric accidents are relatively common. McSwiney says that it is unusual for a pregnancy to proceed to term and the incidence of foetal death is especially high. In treatment the same principles hold true but obviously it is most important to begin treatment with liver or 'Marmite' early in pregnancy.

A tendency to hæmorrhage is common in any case of aplastic anæmia and in leukæmia if it is advanced. Such cases will always be more liable than normal patients to accidents in labour.

REFERENCES

- ADAIR F. L. Quoted by Dieckmann and Wegner *loc cit*
 ADAMSON J. D. and SMITH F. H. *Canad Med Assoc Jour* 1932 **N S**, 26
 669
 BALFOUR MARGARET I. *Ind Med Ger* 1927 **62** 491
 BALFOUR M. and DRURY, J. 'Motherhood in Special Areas of Durham and Tyneside'. The Council of Action 216 Abbey House Victoria Street London 1935 p 25
 BARNES JOSEPHINE. *Jour Obst and Gyn Brit Emp* 1940 **47** 80
 BOYCOTT JOHN A. *Lancet* 1936 **i** 1165
 DAVIDSON L. S. P. and FULLERTON H. W. *Edin Med Jour* 1938 **45** **1**,
 102 and 193
 DAVIES D. T., and SHELLEY V. *Lancet* 1934 **ii** 1094
 DIECKMANN W. J. and WEGNER C. R. *Arch Int Med* 1934 **53** 71

- DOLGLAS, C A, and MCKINLAY, P L "Report on Maternal Mortality in Scotland" H M Stationery Office Edinburgh 1935
- FAIRLEY, N H (Discussion) *Lancet*, 1938 ii, 78
- FULLERTON, H W *Brit Med Jour*, 1936, ii, 523 and 577
- HERMAN, G E *Lancet* 1901, ii, 981
- JERLOV, E *Act Obst and Gyn Scand* 1929, 8, 357
- KILLOGG, I, and MITCHELL, S R *Archiv Int Med* 1936 58 278
- MCKENZIE, C H *Amer Jour Obst and Gyn* 1936 32, 496
- MC SWINEY, S A *Ind Med Gaz*, 1927, 62, 487
- OHLSSON, L *Jour Obst and Gyn Brit Emp*, 1925 32 602 (Abst)
- OSLER, W *Brit Med Jour*, 1919 i 1
- RICHTER, O, MAYER, A L, and BENNETT, J P *Amer Jour Obst and Gyn*, 1934 28 543
- SCHRÖDER, H *Archiv f Gynak* 1899 57 26
- STRAUSS, M B *Jour Clin Invest* 1933 12 345
- STRAUSS, M B *J.A.M.A* 1934 102 281
- STRAUSS, M B *Jour Clin Investigation* 1932 11, 809
- VAUGHAN, JANET M "The Anæmias" Oxford Univ Press 1935
- WHITBY, L E H *Jour Obst and Gyn Brit Emp* 1932, 39 267
- WICKERAMASURIYA, G V *Brit Emp Jour Obst. and Gyn* 1935 42 217
- WILKINSON, J F *Jour Obst and Gyn Brit Emp* 1932 39, 293
- WILLS, LUCY *Brit Med Jour* 1931, i 1059
- WILLS, LUCY, and MEHTA, M M *Ind Jour Med Res*, 1929-30, 17, 777

CHAPTER XXV

DISEASES OF THE NERVOUS SYSTEM IN PREGNANCY

Chorea Gravidarum

It is estimated that 80 per cent of all cases of chorea occur in childhood, but its occurrence in pregnancy is not infrequent. Pregnancy seems in some way to predispose to it, and especially to its recurrence in a patient who has already been the subject of one or more attacks. Usually the disease is of a mild type, interfering but little with the pregnancy. Occasionally, however, its course is extremely severe, there is serious mental disturbance and all our ingenuity may be taxed in order to avoid a fatal issue.

Pathological Considerations Chorea of childhood is usually regarded as a non epidemic encephalitis of infectious origin, the responsible organism being a strepto-diplococcus. In support of this view there are the well known experiments of Poynton and Paine who isolated a strepto-diplococcus from the cerebrospinal fluid of patients suffering from chorea and rheumatism and by injecting it into rabbits produced typical choreiform movements, arthritis and endocarditis, afterwards demonstrating the organism in the brain and meninges. More recently Rosenow injected a short-chained strepto-diplococcus obtained from the tonsils of a patient with chorea, and produced in rabbits and dogs choreiform movements, arthritis and endocarditis, together with microscopic lesions in the brain similar to those described in chorea while control experiments with other micrococci were negative. Nevertheless, this explanation of the origin of chorea has not met with universal acceptance.

The post mortem appearances in the brain are similar to those found in encephalitis lethargica. To the naked eye it usually appears normal, but microscopically there are well marked changes. Those found in a case examined by Greenfield and Wolfsohn may be taken as typical. Everywhere above the pons there was evidence of encephalitis—viz, small round cells, mostly lymphocytes, in both the grey and white matter, the blood vessels were much dilated, and many of the cortical vessels were thrombosed. The round cell infiltration was most obvious in the basal ganglia. There was irregularly distributed nerve cell degeneration in some cases, the nuclei alone remaining. The

same irregular distribution was seen in the basal ganglia. "The pathological basis of chorea minor is a diffuse or disseminated encephalitis, affecting chiefly the corpus striatum and involving the cortex and the pia arachnoid."

It seems probable that chorea of pregnancy arises from the same cause—an infecting organism, and that it has the same pathology. Thus we know that chorea gravidarum most often occurs in women who have suffered from chorea or acute rheumatism, or both, before pregnancy, that it shows exactly the same manifestations, though, as one would expect, they tend to be more severe, and, finally, that in many of the fatal cases there is post-mortem evidence of vegetative endocarditis. In all probability, pregnancy reduces the patient's resistance, and especially the resistance of the central nervous system, to the dissemination of infection, and emotions such as shock or fright may act in the same way. This view is supported by the statistical study of Willson and Preece, who conclude that the chorea of pregnancy is "identically the same disease as Sydenham's chorea in adolescents modified slightly, in certain respects, by its association with pregnancy." Illegitimate pregnancy is said to be a predisposing cause, but Buist found no evidence of that in his cases. In many quarters the disease is regarded as a manifestation of a toxæmia of pregnancy, but it is difficult to reconcile this view with the ascertained pathological facts. Besides, the disease most often shows itself in the first three months of pregnancy, and may arise even in the first month.

While accepting the infection theory, of the site of entry of the infecting organism it is in most cases difficult to be certain, but teeth and tonsils are naturally suspect, and they should in every case be carefully examined. It is in this connection worthy of note that Rosenow succeeded in producing chorea in dogs by injecting the strepto-diplococcus into the pulp of the teeth.

Clinical Features. The disease occurs most frequently in primigravidae. Of the 285 cases collected by Buist from the literature, 60 per cent. were primigravidae, and the experience of others has been similar. There is often a personal history of chorea in childhood or adolescence, or of chorea and rheumatism combined, or the pregnancy may start during an attack of chorea, as happened in 6 of Buist's cases. In 1 of these the disease ceased suddenly at the beginning of pregnancy, in 1 it ceased suddenly after labour, in 1 it remained unchanged during the pregnancy, while

3 became worse but recovered after delivery. There was a family history of chorea in 7 cases, and in 1 the patient's mother had had chorea while pregnant with her. There is often a history of shock, fright or violent emotional disturbance immediately preceding the chorea, but whether there is any ætiological relationship is not clear. With regard to age, the disease seems usually to occur about the age of twenty. It becomes increasingly less common after twenty five, and after thirty it is comparatively rare. In a series of 666 cases collected by Willson and Preece the average age was 22.4 years. The usual time of onset is the 3rd or 4th month, but it may begin in the 1st month, or as late as the 9th, and in 7 of Buist's cases the onset was in the puerperium—within twenty one days of labour. The mode of onset varies. Typical jerky purposeless movements may be first noticed, but not infrequently they are preceded by a period during which the disposition of the patient is changed. She may be dull, irritable, inattentive, sleepless and easily depressed, or actual insanity may precede movements. As in chorea apart from pregnancy, the movements may be of all degrees of severity, so slight as only to be noticed with difficulty, and confined to a single muscle or group of muscles, or so severe that there may be the greatest difficulty in preventing the patient from injuring herself, or in keeping her in bed. Paresis of some degree is a constant feature. In the milder cases the movements cease during sleep, but in the severe cases they are apt to be continuous, preventing sleep and leading to exhaustion, or they may be so severe as to prevent swallowing, with a similar result. In this severe type, mental symptoms, such as loss of memory, mental confusion, hallucinations, or even acute mania, may develop (chorea insaniens). The frequency of chorea insaniens is difficult to estimate. It was present in 8 of Buist's 285 cases. McCann states that mental confusion of greater or lesser degree occurs in every case. Rarely the choreic movements disappear as insanity develops. Rapid pulse, pyrexia, and incontinence of urine and fæces may precede coma and death, and are always of grave significance. When death occurs it is usually due to endocarditis, exhaustion, or septic injuries. Willson and Preece state that there is evidence of heart disease in about one-third of the cases and of cardiac pathology in 87 per cent. of those coming to autopsy. Pyrexia should always arouse suspicion of endocarditis, especially if no other condition can be found to account for it, such as acute tonsillitis. In the milder cases, with proper treatment, recovery

often takes place before delivery. In more severe cases the attack may continue till delivery and gradually cease after it, even without treatment, and complete recovery has usually taken place in two or three weeks. During labour the movements are often much aggravated, so that control is difficult.

Effect on the Pregnancy There is a distinct tendency in severe cases to premature labour and foetal death *in utero*. The cause of foetal death is not known. When the foetus dies the movements tend to diminish, but this effect is neither marked nor constant, and Buist found that there was little or no improvement as long as the foetus remained in the uterus. In 646 of the cases collected by Willson and Preece the pregnancy went to term in 48.6 per cent, was terminated artificially in 26.5 per cent, and ended prematurely and spontaneously in 25 per cent. The child, if the pregnancy goes to term, is practically always born healthy, though possibly there may be in later life a hereditary tendency to develop chorea.

Diagnosis This must be made from hysteria, tic or habit spasm, and Huntington's chorea. In hysteria, the history and general appearance are important, there are often areas of anæsthesia and analgesia, the movements are more purposeful, more rhythmic and more localised, and may cease when the patient thinks she is unobserved. Tic is still more localised, the same movement is always repeated, it is more abrupt, is confined to a single muscle or group of physiologically related muscles, and is more under the control of the will. Huntington's chorea is hereditary, affects several generations, begins in middle life, is chronic, and associated with progressive dementia.

Prognosis Chorea gravidarum in the large majority of cases runs a mild course, and does not materially affect the course of pregnancy. It may clear up before delivery, but more often continues until after labour, when it usually improves rapidly, so that at the end of the third week of the puerperium movements can no longer be detected. Sometimes, however, the movements take several months before they completely disappear, and in one of Buist's cases they persisted for three years. On the whole, the disease tends to be of a more severe type than chorea apart from pregnancy, and insanity is more likely to develop. The maternal mortality is difficult to estimate, as often only the serious cases are reported. French and Hicks record 29 consecutive cases occurring in Guy's Hospital during thirty years, only 3 being fatal (10 per

3 became worse but recovered after delivery. There was a family history of chorea in 7 cases and in 1 the patient's mother had had chorea while pregnant with her. There is often a history of shock, fright or violent emotional disturbance immediately preceding the chorea, but whether there is any ætiological relationship is not clear. With regard to age, the disease seems usually to occur about the age of twenty. It becomes increasingly less common after twenty-five and after thirty it is comparatively rare. In a series of 666 cases collected by Willson and Preece the average age was 22.4 years. The usual time of onset is the 3rd or 4th month, but it may begin in the 1st month or as late as the 9th, and in 7 of Buist's cases the onset was in the puerperium—within twenty-one days of labour. The mode of onset varies. Typical jerky purposeless movements may be first noticed, but not infrequently they are preceded by a period during which the disposition of the patient is changed. She may be dull, irritable, inattentive, sleepless and easily depressed, or actual insanity may precede movements. As in chorea apart from pregnancy, the movements may be of all degrees of severity, so slight as only to be noticed with difficulty, and confined to a single muscle or group of muscles, or so severe that there may be the greatest difficulty in preventing the patient from injuring herself, or in keeping her in bed. Paresis of some degree is a constant feature. In the milder cases the movements cease during sleep, but in the severe cases they are apt to be continuous, preventing sleep and leading to exhaustion, or they may be so severe as to prevent swallowing with a similar result. In this severe type mental symptoms such as loss of memory, mental confusion, hallucinations or even acute mania may develop (chorea insaniens). The frequency of chorea insaniens is difficult to estimate. It was present in 8 of Buist's 285 cases. McCann states that mental confusion of greater or lesser degree occurs in every case. Rarely the choreic movements disappear as insanity develops. Rapid pulse, pyrexia and incontinence of urine and faeces may precede coma and death and are always of grave significance. When death occurs it is usually due to endocarditis, exhaustion or septic injuries. Willson and Preece state that there is evidence of heart disease in about one-third of the cases and of cardiac pathology in 87 per cent. of those coming to autopsy. Pyrexia should always arouse suspicion of endocarditis, especially if no other condition can be found to account for it, such as acute tonsillitis. In the milder cases with proper treatment recovery

often takes place before delivery. In more severe cases the attack may continue till delivery and gradually cease after it, even without treatment, and complete recovery has usually taken place in two or three weeks. During labour the movements are often much aggravated, so that control is difficult.

Effect on the Pregnancy There is a distinct tendency in severe cases to premature labour and foetal death *in utero*. The cause of foetal death is not known. When the foetus dies the movements tend to diminish, but this effect is neither marked nor constant, and Buist found that there was little or no improvement as long as the foetus remained in the uterus. In 646 of the cases collected by Willson and Preece the pregnancy went to term in 48.6 per cent, was terminated artificially in 26.5 per cent, and ended prematurely and spontaneously in 25 per cent. The child, if the pregnancy goes to term is practically always born healthy, though possibly there may be in later life a hereditary tendency to develop chorea.

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cent) In 28 consecutive cases in the London Hospital (Wall and Andrews) 2 were fatal (7 per cent) while of 82 consecutive cases in St Mary's Hospital, Manchester (Fletcher Shaw), all recovered Pinard had 9 cases with one death and Stein 5, all of whom went to term and recovered Amongst these 103 consecutive cases, therefore, the death rate was only 5 per cent The following may be regarded as unfavourable signs movements sufficiently severe to interfere with feeding or prevent sleep serious mental derangement, a pulse persistently over 100 pyrexia over 100° , and retention or incontinence of urine and incontinence of feces Pyrexia, in absence of any other obvious cause should suggest endocarditis, which is always serious, and is found in a large percentage of cases post mortem On the other hand, as long as the temperature does not exceed 99° the outlook is favourable no matter how severe the movements may be The prognosis for the child has been already referred to Chorea may recur in successive pregnancies or after being present in the first may miss one or more pregnancies, to reappear in the third or fourth Of Buist's cases 10 per cent were recurrent. In one of French and Hicks's cases it recurred in three successive pregnancies, and Barnes records a case of Lawson Tait's in which the chorea recurred in four successive pregnancies, in the last proving fatal

Treatment By far the most important thing in treatment is absolute rest in bed, even in mild cases with quietness and freedom from excitement This is in itself sufficient in most cases A milk diet is best and the bowels must be kept acting freely by calomel and salines Any possible source of infection should be sought for, the teeth and tonsils especially being carefully examined and treated if necessary Sedative drugs seem to have but little effect, but chloral combined with sodium or potassium bromide may be given in the hope of lessening the intensity of the movements if they are very severe, and especially if they prevent sleep In one case we seemed to succeed with luminal, gr $\frac{1}{2}$, three times daily, the movements ceasing completely after a few days only, however, to recur later Probably because the movements have a certain resemblance to tetany, parathyroid and calcium have been recommended Albrecht used serum from a normal pregnant woman in one case with a successful result The patient who had also had chorea in her previous pregnancy, was treated for twenty two days by bromides quinine, antipyrin,

etc., without any improvement. Twenty cubic centimetres of serum from a normal pregnant woman were then injected into the gluteal region. In twenty four hours the movements had almost ceased. The improvement continued, and there was a gain of 10 lbs in three weeks. Arsenic, aspirin, salicylate of soda, trional, paraldehyde, lumbar puncture all have their advocates, but there is little proof that they are really beneficial. Fletcher Shaw, believing that chorea is a manifestation of toxæmia, treats his cases by rest in bed, freedom from excitement, diet and eliminative measures—diuresis and diaphoretics, free purgation by calomel and Epsom salts, and a strictly milk diet. His excellent results have been already referred to (p 414).

In serious and intractable cases the question of terminating pregnancy will arise. This is always a serious undertaking in a patient with chorea, and the recorded cases show that while there is a good chance of the movements ceasing and the patient making a rapid recovery after the uterus is emptied, yet this is by no means always the case, the movements often continuing, and the patient dying even after the pregnancy has been terminated. Possibly this is because interference has been delayed too long, or because endocarditis has developed. If, therefore the pregnancy is to be ended this should be done while the patient is in a condition to stand it, and the prognosis should be guarded. "So difficult is it to decide," say French and Hicks, "when induction may do good that we hold it that is seldom the line of treatment to be adopted."

Termination of the pregnancy must, however, be considered in the following conditions —

(1) When movements are so violent that they interfere with sleep and with feeding, and are not sufficiently controlled by sedative drugs

(2) When the pulse and temperature are persistently over 100. If there is this degree of pyrexia the possibility of endocarditis must be borne in mind. If it is present it will, of course, seriously add to the danger of the operation. French and Hicks consider that when there is pyrexia it is too late for induction, but Hellier reports a case twenty one weeks pregnant, pulse 140, temperature 101.2°, with delusions, and dry tongue and sordes, who was treated by induction when sedative drugs had failed. A bougie was inserted into the uterus, and fœtus and placenta were expelled

fifteen hours later Improvement began six days afterwards, and was continued

(3) When the mental condition is confused, and there is a tendency to delirium

The best method of terminating the pregnancy is generally by bougies, or by rupture of the membranes Abdominal hysterotomy is usually inadvisable on account of the difficulty of nursing the patient afterwards

Neuritis in Pregnancy

Neuritis in its milder forms is not uncommon in pregnancy Thus it is not unusual for a patient to complain of "pins and needles" tingling, and numbness in the fingers Neuralgic pains, most often affecting the distribution of the trigeminal, intercostal, ulnar or sciatic nerves, sometimes occur, and may be of the same nature

Severe neuritis is much more rare It may be a mononeuritis or a polyneuritis The former is the more common and usually affects the sciatic, intercostal or trigeminal nerves, while occasionally the optic nerve alone is involved, with consequent loss of sight

Polyneuritis

This is usually more serious than mononeuritis Most of the cases seem to accompany or follow severe hyperemesis, though this is not a necessary precursor, as in a case reported by Stokelbusch, where severe pains, quickly progressing to paralysis of the legs, set in at the 4th month in a previously healthy primigravida

Clinical Features Polyneuritis is most common in women pregnant for the first or second time As stated above, it often comes on in a patient already suffering from hyperemesis gravidarum, or soon after apparent recovery Hence it is apt to be regarded as a manifestation of hysteria, especially if the hyperemesis had been considered to be of neurotic origin, or the weakness may be regarded as simply due to the prolonged starvation There is progressive general weakness, usually affecting first the lower extremities, to which it may be limited, or it may spread to the upper limbs The extensor muscles are usually more involved than the flexors The muscles undergo atrophy, and become soft and flabby Numbness is usually present in the skin over the affected area Occasionally there is hyperæsthesia of the skin, but more often there is only tenderness on

deep pressure over the muscles and nerve trunks, and exquisite pain is produced by putting the nerve trunks on the stretch. Tachycardia is almost always present and may indicate involvement of the vagus, and the tendon reflexes are absent in the affected extremities. An acute ascending paralysis of Landry's type has been described, in which case the disease has of course, involved the spinal cord. Korsakow's syndrome in which the neuritic symptoms are associated with a peculiar mental disturbance (common in alcoholic neuritis) characterised by delirium, loss of memory of recent events, but not of those more remote has been described—once recently by Ledoux who found over thirty other cases in the literature.

Almost any muscle of the body may be involved in the paralysis. Thus there may be squint and diplopia from paralysis of the oculo-motors, or dysphagia from paralysis of the muscles of deglutition, loss of voice from involvement of the intrinsic muscles of the larynx, and dyspnoea from weakness and paralysis of the diaphragm and intercostal muscles. As the nerve lesions are degenerative rather than inflammatory, pain in the affected limbs is rarely a prominent feature but may sometimes be very acute.

Ætiology The disease was formerly regarded as a manifestation of toxæmia of pregnancy, but there is really no evidence in favour of this view. Recent work indicates that it is probably a deficiency disease due to absence of the anti-neuritic factor (vitamin B₁) from the diet (Strauss and MacDonald Plass and Mcngert). If this view is correct it brings the disease into relationship with beri-beri and pellagra. In the Philippine islands a form of neuritis is very commonly associated with a sense of coldness and numbness, paresis, and muscular atrophy with or without œdema, especially in the lower extremities, but sometimes in the upper. The cause of this is believed to be a deficiency of vitamin B₁ in the diet. Further in districts where beri-beri is endemic pregnancy polyneuritis is very frequent. Strauss and MacDonald have observed that in pregnancy polyneuritis there is often an associated gastric anacidity. It is therefore probable that this or a defect in the gastric juice associated with it, is, as in the anæmias of pregnancy (p. 398), an important predisposing cause.

Pathology Mild degenerative changes of the nature of cloudy swelling are found in various organs—kidney, liver, heart, supra-

renals, etc. Petechial hæmorrhages may be present in the brain and meninges, but there is no other gross change there. Microscopically, the peripheral nerves show degenerative changes, and in the spinal cord, especially in the anterior horn, there is swelling of the cells, loss of Nissl substance, and occasionally necrosis. There are, of course, well marked degenerative changes in the affected muscles.

Prognosis. In forty-eight cases collected from the literature by Berkwitz and Lufkin there were nine deaths (18 per cent). Usually, however, the mortality is much higher, and among the twelve cases observed by Plass and Mengert there were 8 deaths (67 per cent). Sometimes recovery takes place rapidly, but it is usually slow, even taking two or three years before it is complete. Pakozdy has recently reported a severe case of polyneuritis with paralysis of the hands and feet, in which labour was induced at the sixth month. Recovery was complete six months later, but there were three recurrences without any further pregnancy at intervals of one and a half to three years. Occasionally the nerve changes are too great to allow recovery, and permanent paralysis results. In fulminating cases death may occur three or four days after the first appearance of symptoms, and is usually due to paralysis of the muscles of respiration or of deglutition. The loss of memory of recent events may be permanent.

Treatment. If the view that the disease is a deficiency one is correct, prophylaxis consists in attention to the diet so as to ensure that pregnant women, and especially those suffering from hyperemesis, eat enough of the necessary accessory food factors. Once the disease is well established treatment is usually ineffective, though in three mild cases Strauss and MacDonald had good results from feeding with large amounts of vitamin B₁ and B₂ concentrates, and iron in the form of the ammoniated citrate, even without interruption of the pregnancy. Autolysed yeast, which contains vitamin B₁ and B₂, together with orange juice and cod liver oil, were given daily. On the assumption that the abnormalities in the gastric juice bring it into ætiological relationship to pernicious anæmia, liver extract may be given in addition. It is usually best to terminate the pregnancy as soon as the diagnosis is definitely established. This should certainly be

if the optic nerve is involved, or the vagus or phrenic, if the disease is severe and rapidly progressive in spite of treatment, and

if Landry's paralysis appear

Cramp

This usually occurs in the legs, especially the calves, and in the later months of pregnancy, and is often worse at night. Its cause is *not fully understood*. That it is *not due to pressure* is shown by the fact that it is often complained of in parts of the body where pressure could not bear any part in its production, *e g*, the back, buttocks and abdominal wall. A more likely explanation is that it is caused by calcium and vitamin D deficiency (vitamin D controls calcium absorption), which leads to hyperexcitability of the nervous system. We have already emphasised (p 53) the importance of milk, cheese, butter and *fresh green stuffs* in the diet of the pregnant woman, and failing these, cod or halibut liver oil or irradiated ergosterol should be taken, although they cannot replace milk, which is valuable for its calcium as well as its vitamin D content.

Great relief can be afforded in cramp by the administration of calcium lactate, grains 20, thrice daily by the mouth. Cod liver oil should also be given—one tablespoonful daily. Temporary relief may be given by massage, or by bending the body with the legs extended so as to put the affected calf muscles on the stretch.

Sleeplessness

This may be troublesome, especially in the last three months of pregnancy, and is largely due to taking too little outdoor exercise. Daily exercise out of doors (if possible walking at a fairly brisk pace with an agreeable companion), avoidance of tea or coffee at the evening meal, a hot bottle in the bed, open windows, light, though sufficiently warm, bedclothes, and a quiet bedroom, will do much to secure sleep. Windows and doors rattling in the wind should be adequately silenced. It is often useful to read for a short time after going to bed, choosing a book that *has not been read before going to bed* and that while interesting is not too exciting. The author has found the novels of Sir Walter Scott ideal in this respect. It is an excellent plan, too, to keep a thermos flask, in which is a cupful of hot milk, Ovaltine or Horlick's malted milk, by the bedside, so that if wakeful it can be partaken of during the night. Drugs are best avoided. The possibility of sleeplessness being an early manifestation of osteomalacia should be kept in mind (p 57), and that undue activity of the *fœtus in utero* may be another early sign, and in

itself may prevent sleep. Relief will in this case be afforded by calcium and vitamin D.

Abdominal and Pelvic Pain in Pregnancy

Fully 80 per cent of women suffer from abdominal pain of greater or less degree during pregnancy, though its origin is often obscure or impossible to determine with certainty. The causes may be classified as follows —

(1) *The Uterus and Its Appendages* (a) *Uterine Distension* It is doubtful whether the stretching of the uterus by a normal pregnancy ever gives rise to pain. Rapid distension however, almost always does so as for example in acute hydramnios and occasionally in hydatidiform mole especially when a sudden distending concealed hæmorrhage occurs between the mole and the uterine wall. In concealed accidental hæmorrhage there is often a sudden severe pain of a tearing or bursting character and the uterus becomes characteristically hard and tender.

(b) *Stretching of Round Ligaments* This often causes pain between the 12th and 30th weeks. The pain is felt along a line from the middle of Poupart's ligament on either side to the insertion of the round ligament into the cornu of the uterus. Relief is often obtained by lying on the painful side.

(c) *Threatened Abortion or Premature Labour* The pains are intermittent usually start in the back and come round to the front of the abdomen are accompanied by hardening of the uterus and usually by more or less hæmorrhage from the vagina.

(d) *Uterine Fibromyomata* These may give rise to pain under three conditions (1) Red degeneration. The pain is usually slight of a dull aching character and there is tenderness over the tumour. Rarely the pain may be extremely severe accompanied by vomiting and all the signs of an acute abdomen (p. 504). (2) Torsion of the pedicle of a subperitoneal fibroid causing congestion of the tumour and distension of its capsule. (3) Incarceration of a fibroid tumour in the pelvis a rare occurrence. It gives rise to down bearing pain in the pelvis often radiating down the thighs (sciatica) and usually there is retention of urine from pressure on the neck of the bladder or urethra.

(e) *Retroverted Gravid Uterus* This condition may give rise to acute abdominal pain and distress between the 12th and 16th weeks (p. 296). The distended bladder forming a large symmetrical and central swelling above the pubes the incontinence

of urine, and the position of the cervix, together with the swelling (the fundus) in the pouch of Douglas, are characteristic

(f) *Breech Presentation* Occasionally, when the head is in the right hypochondrium it gives rise to severe pain there, the cause of which is not clear, but it disappears if external cephalic version is performed

(g) *Tubal Gestation* Before rupture there is usually pain of a colicky nature, due to stretching of the tube and its covering peritoneum in the corresponding iliac fossa. Rupture of the tube is characterised by a sharp, sudden cramp-like pain, which is usually preceded by one or two periods of amenorrhœa, it is accompanied by a feeling of faintness and sickness, and followed by vaginal bleeding (p 180). If there is diffuse intra peritoneal hæmorrhage, pain may be referred to one or both shoulder tips (p 181). If the hæmorrhage is less severe so that the blood collects in the pelvis, forming a pelvic hæmatocele, the pain may be referred not to the shoulder but to the back between the scapulæ, to the epigastrium, or to the hypochondrium, where it may be so severe as to simulate renal colic

(h) *Salpingitis* does not occur during pregnancy

(i) *The Ovaries* An ovarian cyst is, during pregnancy, more liable to undergo torsion of its pedicle. The resulting pain is usually severe and is accompanied by vomiting fever and abdominal distension. In the early weeks of pregnancy there may be ovarian pain with tenderness over the "ovarian point" (about 3 inches in a vertical line above the pubic spine). It may be due to stretching of the capsule of the ovary by growth of the corpus luteum, but a more likely explanation, especially in view of the comparative rarity of this form of pain, is that it is caused by a sudden hæmorrhage into the corpus luteum

(j) *Varicocele of the Broad Ligament* This is no doubt sometimes a cause of a dull aching pain in the pelvis, worse on standing and immediately relieved by lying down. The abnormality cannot be detected on bimanual examination, because when the patient lies down the veins are emptied

(2) *Extra-Uterine Causes* Most of these have been already referred to in detail, such as appendicitis, pyelitis, etc. Renal or ureteral calculus is not uncommon in pregnancy, but its signs and symptoms are the same as in the non pregnant, and X rays are necessary for diagnosis. Painful conditions in the gall bladder

are apt to be aggravated by pregnancy, especially in the later months, probably because of stasis from atony of the gall bladder and increased cholestrin content. In the pre eclamptic state severe epigastric pain is a well known and urgent symptom. Various explanations are given of it, none very satisfactory, such as liver necrosis, subcapsular hæmorrhages, and spasmodic contraction of Oddi's sphincter. As pregnancy increases intestinal stasis, pains from this cause are not infrequent, usually colicky in character, and accompanied by flatulence, they are relieved by an enema or by an aperient. When they arise in the small intestine they are diffused over the centre of the abdomen, when in the large intestine they tend to be localised over the segment of bowel involved, namely, ascending, transverse, or descending colon.

According to Middleton, pain in the renal region usually on the right side, and in a multipara, is very suggestive of stricture of the *ureter* especially if it has begun during pregnancy as a backache, and has been intensified by successive pregnancies. The pain may be only a mild backache, or be so severe as to simulate renal colic. It may be associated with a mild infection, but in more than half the cases the urine is normal. A pyelogram is necessary for diagnosis and the treatment is ureteric dilatation.

Pain in the small of the back, or over the sacrum, is most often a 'fatigue pain' and is relieved by rest. It is particularly liable to occur in women who are anæmic and rundown. Possibly the exaggerated lordosis of the later months of pregnancy is a contributory factor. In one of our cases there was sacralisation of the last lumbar vertebra. The patient, who was in her third pregnancy, had never suffered from backache before her first pregnancy began, but in the first month of that and subsequent pregnancies the backache started. The pain was located on both sides of the lumbar spines and over the upper part of the sacrum, and was completely relieved by lying down. Between pregnancies the pain persisted but was less severe.

There is reason to believe that a diet deficient in calcium and vitamin D may, even in this country, be a not infrequent cause of pain in the back and pelvic girdle. It is, of course, common in osteomalacia, which is prevalent in parts of India and Northern China, but in the depressed industrial areas of England and Wales it is probable that minor degrees of this disease are more common than is generally supposed. If there is reason to suspect it the

patient should be given calcium in the form of calcium lactate or phosphate, with cod liver oil (three tablespoonfuls daily) or radiostoleum, or irradiated ergosterol. According to Preston Maxwell, restlessness and sleeplessness with muscular twitching and sometimes violent movements (tetanic?) of the foetus, may be early symptoms of the disease.

There is no evidence that stretching of the anterior or lateral abdominal walls causes pain in pregnancy, though Blakeley believes that he has occasionally observed pain due to stretching of the tissues about the navel.

Pelvic Osteo Arthropathy A dull aching pain with tenderness over one or both sacro iliac joints or the symphysis pubis, or over all these joints is often due to excessive softening and relaxation of the ligaments. James Young, who calls the condition pelvic osteo arthropathy, found 34 cases in a series of 4512 pregnant women. The pain is aggravated by walking, which in severe cases may be impossible, and there is often a characteristic waddling or strutting gait. This is probably caused by an effort to hold the body in the easiest position. The abnormal gliding movement at the pubes may be felt by placing a finger in the vagina and the thumb over the symphysis while the patient stands first on one foot and then on the other or it may be demonstrated by X rays. In some cases the onset of the symptoms dates from a slight trauma such as a slip or fall. As to treatment rest in bed for a short time is usually sufficient in the mild cases while in the more severe the pelvic girdle should be fixed firmly by adhesive strapping or a well fitting belt. In case there is an osteomalacic element in the pain (see above) it is well to give calcium and fish liver oil at the same time. The disability usually passes off by the end of the puerperium but occasionally persists longer and may recur in subsequent pregnancies.

REFERENCES

- BARNES, R. *Trans Lond Obst Soc*, 1889 10, 147
 BREKOWITZ, N. J., and LUFKIN, N. H. *S G O*, 1932 54, 743
 BLAKELEY, S. B. *Jour Am Med Assoc*, 1933 101, 970
 BUIST, R. C. *Trans Edin Obst Soc*, 1894-5, 20, 134
 FRENCH, H., and HICKS, H. T. *Practitioner* 1906 77, 178
 GREENFIELD, J. G., and WOLFSON, J. M. *Lancet*, 1922, ii, 603
 HILLIER, J. B. *Lancet*, 1907, i, 1736
 LEDOUX, E. *Presse Médicale*, 1929 37, i, 516
 MCCANN, P. J. *Trans Lond Obst Soc*, 1891, 33, 413
 MAXWELL, J. PRESTON. *Jour Obst and Gyn Brit Emp*, 1932 39, 764

- MIDDLETON, D S *Trans Edin Obst Soc*, 1928-9, 49, 103
 PAKOZDY, K *Deutsch med Woch*, 1929, 55, 11, 1509
 PINARD A *Bull soc d'obst et de gyn*, 1913, 16, 430
 PLASS, E D, and MENGERT, W F *Jour Am Med Assoc* 1933 101, 2020
 ROSENOW, E C. *Amer Jour Dis Child.*, 1923, 26, 2nd
 SHAW, W FLETCHER *Jour Obst and Gyn Brit Emp*, 1907, 11, 289
 STOKELBUSCH O *Deutsche Zeits f Ges Gericht Med* 1928, 12, 241
 STRAUSS M B, and MACDONALD, W J *Jour Am Med Assoc*, 1933 100,
 1320
 WALL, C, and ANDREWS, H R *Brit Med Jour*, 1914 1, 223
 WILLSON, P and PREECE, A A *Archiv Int Med* 1932 49 471
 YOUNG JAMES *Proc Roy Soc Med*, London, 1939, 32 1591

CHAPTER XXVI

DISEASES OF THE NERVOUS SYSTEM—(continued)

Epilepsy and Pregnancy

THAT there is a relationship between epilepsy and the generative organs has long been known. Thus epilepsy is not seldom aggravated at the menstrual periods, and it may even appear for the first time at puberty, especially in those with a hereditary predisposition to it. Such hereditary disposition is, however, by no means necessary, and Muskens found that out of 1,000 epileptic women there were twenty nine in whom the fits first appeared at the commencement of the menses, and in whom there was no hereditary history of epilepsy. Again, epilepsy may appear for the first time during pregnancy. Most writers on epilepsy refer to undoubted instances of this. Thus Muskens mentions the case of a woman aged thirty two who married at eighteen, and had her first epileptic attack in the sixth month of her first pregnancy, the fit leading to a miscarriage. After this she had myoclonic shocks every four weeks and also epileptic headaches. Her sister was an epileptic. Of forty one cases of epilepsy in pregnancy recorded by Aldren Turner in two the fits first came on in pregnancy.

Effect of Pregnancy on Epilepsy. The effect of pregnancy on an already established epilepsy is variable. Sometimes there seems to be no effect whatever. Not seldom the fits are made worse, either more frequent, or more severe, or both, and may even reach the status epilepticus. Again, the attacks may cease completely during pregnancy to reappear in the puerperium, or they may cease during the early months but return in the later months, and finally an epilepsy that had been apparently cured for years may reappear in pregnancy. A

Nerlinger gives the following figures regarding 92 women observed in 157 pregnancies. In 44 (28 per cent) the fits ceased entirely during pregnancy, in 12 they were fewer, in 23 attacks occurred, but the frequency before and after the pregnancy is not given, in one the fits were absent at the beginning of pregnancy but became frequent at the end. In another they were frequent at the beginning, and then ceased until eight days before delivery. In a further pregnancy in this patient the attacks were again more

frequent at the beginning and ceased completely in the last months. In 18 pregnancies (11 per cent) the attacks were uninfluenced, in 57 (36 per cent) they became more frequent and more severe.

Aldren Turner gives figures relating to the influence of pregnancy, the puerperium and lactation on 41 women in whom he observed 61 pregnancies. Pregnancy was the original cause of the fits in two cases, these were both young women in their first pregnancies. It induced a relapse in 21 cases, in 7 of whom the relapse was associated with quickening. Pregnancy was temporarily beneficial in 6, and in one made no difference. In one of the 6 although there was freedom from attacks in one pregnancy, they became more frequent in the next. Delivery was the original cause in 5 cases, and induced a relapse in 17. Of the 5 cases caused by confinement, the onset in one was in the form of status epilepticus, and the disease continued for many years in a chronic form. In one case it began in a fourth confinement, in three others in the first. Lactation was the original cause in 3 and induced a relapse in 6. Cases have been recorded in which what appeared to be a true eclamptic attack was followed by recurring attacks of minor epilepsy.

In one of Turner's patients in whom the fits first occurred during lactation, they were repeated after three successive pregnancies during nursing only, and ceased on weaning. In two cases the fits which originated while suckling the first child, returned while nursing the second, and eventually persisted as the confirmed malady. In another case suckling induced a relapse after four years' remission. "From this it is permissible to state that lactation stands in the same relation to the onset and relapse of epilepsy as pregnancy and the puerperium, and that the disease if started in this way may persist as the confirmed malady in those who are predisposed to it."

It is thus justifiable to conclude that epilepsy may appear for the first time during pregnancy,¹ labour, or the puerperium, that there are undoubtedly cases in which the fits are temporarily and even permanently arrested by pregnancy, but that it is more common to find the fits increasing in frequency and severity, or even a recurrence of attacks that have been in abeyance for years.

¹ Both Nehringer and Neu deny this and hold that not one of the cases has been proved. They rightly point out that if pregnancy were a cause of epilepsy it should be much more common in women than in men which is contrary to experience.

De la Motte records the case of a woman who had five daughters and three sons, when pregnant with sons she always had epileptic fits, but never when carrying daughters. *Muskens* records the case of a woman who had vomiting attacks and headaches from infancy. At the age of fifteen she menstruated for the first time and had epileptic fits. While pregnant on three different occasions with daughters she had no fits, but when pregnant with a boy she had many fits. After her last confinement they ceased altogether.

Effect of Epilepsy on Pregnancy There is little tendency to the premature interruption of pregnancy even in the status epilepticus. This is one of the features that help to distinguish status epilepticus from eclampsia. *Nerlinger's* statistics show that in fifty six women who had fits in pregnancy (102 pregnancies) 100 pregnancies went to term, and two ended prematurely. Of 153 pregnancies, only three ended in abortion, and there was no evidence that the fits were the cause of the abortions.

Status Epilepticus in Pregnancy The augmentation of the fits in pregnancy may result in the status epilepticus. In some of the cases recorded by *Turner*, in which epilepsy appeared for the first time in pregnancy, it took this form at its first onset. It is remarkable, however, that very few cases of status epilepticus are recorded in the literature. A case was recorded by *Neu* in 1907, one by *Jardine* in the same year (774 fits), one by *Sachs* in 1910, and one by *Miller* in 1912. All were fatal.

Relation between Epilepsy and Eclampsia Knowing as little as we do regarding the ultimate causes of either epilepsy or eclampsia, it is not surprising that many regard them as allied diseases, without any very hard and fast dividing line between them. It is probable that both are caused or at least aggravated, by endogenous toxins, and that they are predisposed to by a condition of hyperexcitability of the nervous system increased during pregnancy. Again, it is alleged that a careful enquiry into the family history of eclamptics will always reveal a familial tendency to epilepsy. However this may be, it is probably true that, by reason of an unduly excitable nervous system, certain women are predisposed to eclampsia. One patient goes into eclamptic convulsions, and another does not, with the same degree of albuminuria, elevation of blood pressure and other signs of toxæmia. *Duhrssen*, too, recognises two forms of eclampsia—eclampsia reflectoria (5 per cent), in which the individual

predisposition to nervous explosion plays an important part and in which there is little evidence of liver or kidney disease and eclampsia toxica (90 per cent) Sachs Curschmann and others also believe in this individual predisposition—present at all times but increased in pregnancy. According to Muskens if bromide of camphor is given to pregnant cats a smaller dose will cause epileptiform convulsions than in a cat that is not pregnant. Blumreich and Zuntz showed that creatin applied to the cerebral cortex or injected into pregnant animals produced convulsive fits—a result rarely obtained in the non pregnant animal. Too much weight however should not be attached to these speculations and it must be recalled how often pregnancy leads not to an aggravation but to a temporary cessation of the epileptic attacks.

Diagnosis between Epilepsy and Eclampsia In some cases the resemblance is so close that diagnosis is possible only at post mortem examination if even then. Neu says I know of no certain means of diagnosis. Status epilepticus is especially difficult. The following are the chief helpful points.

(1) *The History* This is most important—a history of epileptic attacks prior to pregnancy or even only in some member of the family. Too much stress must not however, be laid on this for eclampsia may occur in an epileptic. In eclampsia there is usually a history of pre-eclamptic symptoms—severe headache visual disturbances etc. Again the epileptic attack is often preceded by a cry and this when present is usually diagnostic.

(2) *The Time of Onset* Eclampsia usually sets in late in pregnancy but may rarely occur as early as the third month (Olshausen Goedecke) and De Lee has met with an apparently genuine case at the 10th week.

(3) *Number of Fits* Epileptic attacks apart from the rare status epilepticus are usually single isolated attacks.

(4) *Albuminuria* This is rare in epilepsy, though it sometimes does occur (trace only) immediately after a convulsion. It is true that eclampsia may occur without albuminuria but it is rare, and in a severe case it is always present.

(5) *Quantity of Urine* The urine in eclampsia tends to be scanty, in epilepsy there is no change. In both conditions there may be incontinence.

(6) *Blood Pressure* In epilepsy the blood pressure is little changed. In eclampsia the blood pressure is always raised above 130 mm.

(7) *Premature Interruption of Pregnancy* This rarely occurs as a result of epileptic fits, even of the status epilepticus. In eclampsia it is almost the rule.

(8) *Stigmata of Degeneration* In epilepsy there may be such stigmata of degeneration as a high narrow or deformed palate, dental anomalies, deformities of the ears, syndactyly, polydactyly, etc.

Treatment This should be along the same lines as if the patient were not pregnant. Regularity of the bowels is of great importance. A light diet at regular and not too frequent intervals and with a minimum of red meat, should be ordered. It may also be advisable to cut out of the diet all other purin containing foods such as meat soups, beans, peas, lentils, eggs, cured fish, brown or wholemeal bread and strong tea or coffee. Of drugs the best for general use is probably sodium bromide which may be given thrice daily after meals. It may be possible to give it in a single dose of $\frac{1}{2}$ to 1 dram, four hours before the fit is expected if it comes at regular intervals. Luminal may in some cases give better results. It should be begun carefully giving at first gr. i daily and increasing gradually till the dose is found which just keeps the fits under control.

In *status epilepticus* absolute rest and quiet in a darkened room, cleansing the bowel by large enemata, potassium or sodium bromide and chloral *per rectum* and the cautious use of chloroform by inhalation should be tried. Instead of bromide and chloral, which are cardiac depressants, paraldehyde in doses of 4 drams dissolved in olive oil may be given by the rectum and repeated in 4 to 6 hours. Featherstone has recently recommended a barbiturate such as nembutal or sodium amytal intravenously, the injection being made very slowly to avoid a too marked fall in blood pressure. The termination of pregnancy is discussed below.

The Question of the Termination of Pregnancy In ordinary epilepsy there is usually no justification for terminating the pregnancy. If however, the fits are becoming more and more severe with mental symptoms threatening or if the patient's life is being endangered, then termination of the pregnancy is justified without regard to the life of the foetus. Regarding the termination of the pregnancy in *status epilepticus*, opinion is divided. Neu's case died undelivered, and he advocates induction. Sachs's case died in coma during attempts to terminate the pregnancy by

packing the uterus, and he therefore thinks there should be no interference, because the necessary manipulations increase the excitability of the already over excitable cerebral cortex. In Jardine's case, the patient went into labour at term, and the fits then started. When the os was half dilated, dilatation was completed by hand, and the child, weighing $7\frac{1}{2}$ lbs., was delivered by version. She died in coma after 774 fits.

The best method of treatment is probably that adopted in fulminating eclampsia when medical measures fail, and the os is closed—namely evacuation of the uterus by abdominal Cæsarean section under general anæsthesia. This should be carried out if a brief trial of medical measures brings no relief. Attempts at the induction of abortion by hydrostatic bags, bougies, or other means are too slow and uncertain in their results to be of any value, and are only likely to increase the frequency and severity of the fits.

The Question of Marriage There is a common belief that marriage helps in the cure of epilepsy. Certainly cases are recorded in which marriage seems to have been followed by permanent cessation of the fits. Muskens mentions a patient, who since the age of two, had two or three fits daily. She married, had seventeen children and had been free from fits for fourteen years. A sister of this patient also had fits—as many as two or three daily, but had no more after marriage. Sach's patient with status epilepticus had two sisters, both of whom had been epileptic since puberty, but had been well since marriage and had healthy children. The third sister, also epileptic, married on the advice of a doctor, and in the hope of curing her epilepsy. After the beginning of pregnancy, however, the fits became more frequent, and finally ended at the fifth month in status epilepticus, which proved fatal. The reaction to marriage is therefore very uncertain. We have previously seen how uncertain is the effect of pregnancy on epilepsy, and that in a large percentage of cases the fits are made worse. Apart altogether from such a consideration as this, it is inadvisable from the eugenic point of view to encourage marriage of an epileptic, because of the likelihood that some of the children will suffer in the same way, and in turn transmit the disease. Russell Brain computes the risk of epilepsy in the children as 1 in 10, that is, if an epileptic has ten children, one will probably be epileptic and that most commonly the first born.

REFERENCES

- BLUMREICH L. and ZUNTZ L. *Archiv f Gyn* 1907 65 737
- BRAIN RUSSELL. Inheritance of Epilepsy in *The Chances of Morbid Inheritance* Edited by C. I. Blacker 1934 Lewis London 73
- DÖRRSEN A. *Archiv f Gyn* 1893 43-44 49
- JARDINE R. *Jour Obst and Gyn Brit Emp* 1907 12 78
- MILLER G B. *Im Jour Obst and Gyn* 1912 63 747
- MUSKENS L J J. Epilepsy Comparative Pathogenesis Symptoms and Treatment London 1908
- NERLINGER. Über die Epilepsie und das Fortpflanzungsgeschäft des Weibes in ihren gegenseitigen Beziehungen Inaug Dissert. Heidelberg 1889
- NEU M. *Monats f Geb u Gynäk* 1907 26 27
- SACHS E. *Monats f Geb u Gynäk* 1910 32 649
- TURNER W A. Epilepsy a Study of the Idiopathic Disease Macmillan London, 1907

CHAPTER XXVII

DISEASES OF THE NERVOUS SYSTEM—(*continued*)

Reproductive Insanity

INSANITY is the product of two factors, stress and heredity. The process of reproduction entails a certain amount of mental strain to which most patients adapt themselves without much difficulty, but a number, especially those with a psychopathic or neuropathic heredity, fail to do so adequately, and more or less mental aberration is the result. The frequency of reproductive insanity is about 1 in 1 000 and it accounts for 7.5 per cent. of all the cases of insanity in women. A heredity of mental disease can be traced in almost half the cases and illegitimate pregnancy is another important predisposing factor, especially of that form of reproductive insanity occurring during pregnancy. In such cases about 25 per cent. are illegitimately pregnant. Anything else that causes unusual worry or anxiety, such as death of, or desertion by the husband, tends to act in the same way.

The mental breakdown may occur during pregnancy, in the puerperium or during lactation.

Insanity of Pregnancy This is the least frequent variety. In a series of 259 cases of reproductive insanity recorded by Robert Jones at Claybury Asylum, 56 or 21.6 per cent., occurred during pregnancy. It may come on early in pregnancy or towards its end. In Jones's 56 cases the disorder set in before the third month in 25 per cent. and after the sixth month in 34 per cent. It is often described as an accentuation of the morbid longings and irritability that are liable to be present in neurotic women during pregnancy. Usually it is gradual in onset, of the manic depressive type, and associated with sleeplessness, constipation, morbid broodings and melancholia. Delusions often develop with aversion to her husband, refusal of food and a marked suicidal tendency. If it sets in early in pregnancy recovery is usually said to be likely to occur before delivery. But that the chances of this are not really very great can be seen from the fact that of Jones's 56 cases only 3 were discharged cured before labour. If the trouble starts during the later weeks of pregnancy recovery is likely to be delayed till the puerperium.

Puerperal Insanity This is the kind most often met with

In Jones's series it accounted for 120 (46·3 per cent), and is therefore twice as frequent as insanity of pregnancy. About half the cases are associated with puerperal sepsis, which must therefore be regarded as an important predisposing cause. The earlier the trouble sets in after delivery the more likely it is to be of the acute maniacal type, whilst those starting later are likely to be of the melancholic type, and on the whole more protracted. Usually the disorder starts about the fourth or fifth day of the puerperium. The most suggestive sign of impending trouble is sleeplessness and perhaps headache. Soon she begins to refuse food, which may be associated with delusions to the effect that attempts are being made to administer poison. There are often hallucinations, chiefly of hearing. The temperature at this time may be raised, the pulse may be rapid, the skin sallow or flushed, the tongue dry and coated and the bowels constipated. Especially common is dislike of her husband and child, and she is often infanticidal or suicidal, or both. She becomes restless, confused and irritable, her memory fails and she often loses all self control. Eroticism is frequent, evidenced by sexual excitement, and indecent language and conduct. The restlessness, the constant movement, and the lack of sleep and food may in a short time lead to extreme and even fatal exhaustion.

Lactational Insanity This term is usually restricted to insanity occurring during lactation, from the sixth week after delivery onwards. It accounts for about one third of all the insanities of reproduction (32·5 per cent of Jones's cases), and most often sets in towards the end of a prolonged period of suckling, when the mother is anæmic and exhausted, and especially when pregnancies have rapidly succeeded each other. The most common type is a subacute depressive form of confusional insanity, with ideas of unworthiness. The illness usually begins gradually with sleeplessness, restlessness, perhaps refusal of food and neglect of, or actual aversion to, her husband and child. Constipation is always present, she looks pale and ill, delusions and hallucinations make their appearance, and though generally depressed there may be periods of excitement. About half the patients are suicidal, and infanticidal tendencies are even more marked than in puerperal insanity. According to Cole, there is a special tendency to lung complications.

Prognosis Of all the forms of insanity the outlook is best in the insanities of reproduction. About 75 per cent recover completely,

10 per cent die, and the remainder become chronic or end in dementia. Speaking generally, the more rapid the onset, and the more acute the symptoms in all forms, the better is the prognosis. According to Jones when the insanity of pregnancy sets in during the early months, the outlook is better than if it starts in the later months. Of his 56 pregnancy cases, 48 per cent recovered and 21 per cent died. In puerperal cases, complete recovery usually takes place in from three to five months. The sooner the attack comes on after delivery, and the more acute the symptoms, the better the chance of early and complete recovery. Of Jones's 120 puerperal cases, 88 (73 per cent) recovered and 18 (10 per cent) died. In lactational cases the return of the menses is a good sign. Of Jones's 83 cases, 49 (60 per cent) recovered, and 14 (16 per cent) died. The death rate is therefore highest in insanity of pregnancy and lowest in the puerperal form. The prognosis is particularly good when the insanity is associated with sepsis or eclampsia.

Treatment Nothing is to be gained from terminating the pregnancy. Besides, after an operation asepsis might be extremely difficult to maintain on account of the deranged mental state. Good nursing is the great essential in treatment, and amongst the poorer classes this can, as a rule, only be secured by removal to an institution. If the patient's means allow, and in order to avoid the stigma of certification, home treatment may be undertaken except in the worst cases. Specially trained mental nurses are usually advisable. In pregnant cases, change of air and scene may bring about cure, especially if the pregnancy is not far advanced. Treatment of constipation is most important.

In puerperal cases, sepsis, if present, must of course be treated, and breast feeding should always be stopped and the child entirely separated. In lactational cases the patient is often anæmic and exhausted, and therefore abundance of good food, tonics containing iron and phosphates, and restful change of air and scene will all be beneficial. In all forms it is of the greatest importance to procure sleep. Suitable hypnotics, such as paraldehyde, cerebrol or medinal, may be used, but it is best to avoid them if possible, and to encourage sleep by outdoor exercise, fresh air, hot baths at night, quiet surroundings, etc. Some alcohol at night, possibly in the form of stout, may assist toward the same end. Equally important is it to treat constipation and make the patient take plenty of nourishment. It may become necessary to adopt forced

feeding by a nasal tube or otherwise, but it is much better if the patient can be coaxed in her more rational moments to take food naturally, and no pains should be spared to this end. The possibility of suicide or infanticide must be constantly in the minds of the attendants. A further pregnancy should not be allowed for at least two years after complete recovery.

Encephalitis Lethargica

This subject with the entire literature has been so recently and so thoroughly reviewed by Frederick Roques that it is unnecessary to do more than summarise his conclusions.

That the disease is not rare in pregnancy is shown by the fact that Roques in 1928 was able to describe 40 cases and collected 150 others from the literature. The course of the disease is not modified by pregnancy, while in the majority of cases the pregnancy is not noticeably affected by the disease and proceeds to term. In cases of greater severity however labour may come on prematurely or foetal death may take place before term while in the worst cases the mother may die before delivery. Transmission of the disease to the foetus is rare but has occurred occasionally and the foetus may then be dead born or be born alive and with congenital encephalitis. If however the child is born healthy, and signs of encephalitis do not develop in early infancy there is little likelihood of their appearance later and there is no evidence to suggest that any later mental impairment will arise.

Diagnosis must be made from pre-eclamptic toxæmia hyperemesis gravidarum and chorea gravidarum.

Pre eclamptic Toxiemia Encephalitis may begin with nausea vomiting and headache followed by drowsiness and visual disturbances e.g. flashes of light diplopia etc. In pre eclampsia the albuminuria is usually considerable in encephalitis slight but it may be marked. The urine however is not diminished there is no œdema and the blood pressure is normal. In pre eclampsia fever is rare in encephalitis it is common. Pre eclampsia rarely occurs before the sixth month encephalitis often. Pre eclampsia usually occurs in primigravidae encephalitis has no preference. The blood urea and non protein nitrogen are often raised in toxæmia but in encephalitis they are normal. It is said that the pathological changes in the liver and kidneys may be similar in both diseases. Some cases of encephalitis

lethargica begin with a convulsion, which may simulate eclampsia very closely, but in the latter there have nearly always been pre-eclamptic signs. If the patient with encephalitis is comatose she can generally be roused by speaking or shouting, and when aroused answers questions intelligently.

Hyperemesis gravidarum may be suspected and the diagnosis may be extremely difficult. Headache and fever are usually present from the onset in encephalitis, but are absent in hyperemesis at least until the late stages. Many of the other typical symptoms of encephalitis, e.g., nervous manifestations, may be absent or may only develop late.

Chorea gravidarum may be very closely simulated. There is usually a previous history of chorea and there may be cardiac complications, which in encephalitis are unusual.

Treatment. The pregnancy should be ignored and treatment carried out along the usual lines. Premature interruption of the pregnancy is not advised as the course of the disease and the mortality are not favourably influenced thereby.

Parkinsonism and Pregnancy

This disease is nearly always made worse by pregnancy, or it may set in for the first time during or after pregnancy. Usually the exacerbation occurs in the early months. The pregnancy is not, however, in cases of slight or moderate severity, affected by the disease but in the most severe cases there is a tendency to premature labour. Labour is easy and is said to be accompanied by less pain than usual. There is no evidence that the outlook for the child is made worse by the presence of Parkinsonism, apart from the slight tendency to prematurity, and there seems to be no liability to mental impairment.

Treatment. Prophylaxis is important. Pregnancy should be avoided for four years at least after an acute attack of encephalitis lethargica, on account of the apparent tendency of pregnancy to cause the onset of Parkinsonism, and it should be avoided for much longer if there appears to be any tendency to the disease. If a Parkinsonian woman becomes pregnant she should be carefully watched. Should any indication of aggravation of the disease appear the pregnancy should be ended without delay. If Parkinsonism sets in for the first time in pregnancy, abortion or premature labour should be induced at once.

if the rare occasions on which a Parkinsonian woman is

allowed to go to term, it is necessary to observe the labour very carefully and to take measures to conserve the patient's strength as much as possible. If the second stage is unduly prolonged forceps should be applied. *Breast feeding is contra-indicated*

Disseminated Sclerosis

This disease is rarely met with in pregnancy. In University College Hospital there have been only two cases among 17,284 women in the last ten years, and both of these were specially referred.

standing and at the moment relatively inactive case of disseminated sclerosis I can find no neurological indication for the termination of pregnancy. A therapeutic abortion will have the same effect as a normal pregnancy and confinement. The proper treatment is rest during the remainder of the pregnancy." In accordance with this advice the patient was allowed to go home, and instruction was given that she should rest, and be adequately fed and should not get up too soon after confinement. Nothing more was heard of her until the following letter, dated August 4th, 1936, was received from her doctor: "Mrs C was confined this morning. The result was a boy, alive and healthy. The labour started at 2 a.m., the waters broke at 7 a.m., and the child was born at 9.15 a.m., a perfectly normal labour throughout. So far both are doing well." In reply to an enquiry a further letter was received, dated March 5th, 1937: "Mrs C remains exactly the same. The pregnancy and labour have made no difference to the disseminated sclerosis."

If pregnancy is allowed to continue the patient should rest as much as possible and for a considerable time after delivery. The disease seems to have little or no influence on the course of the pregnancy or labour.

Paralysis in Pregnancy and Labour

Many cases of pregnancy have been recorded in women who had complete motor and sensory paralysis from the waist downwards (Ware, Amand, Routh, Schumann, and Drummond Robinson). The paralysis may be due to fracture of the vertebræ, to disease of the vertebræ, to pressure by tumours, or to transverse myelitis. Pregnancy usually proceeds normally to term except for the disabilities attributable to the paraplegia, such as retention of urine, cystitis, etc., and labour is painless. The contractions of the uterus are of normal strength and frequency, though there is usually no attempt to use the accessory muscles, and third stage contraction and retraction do not seem to be interfered with. In this connection we may recall the classical experiments of Sir James Y. Simpson, who removed the spinal cord of sows from the first dorsal vertebra downwards a few days before term. Labour came on at the normal time and proceeded regularly. In Routh's case, a multipara who sustained a fractured spine by a fall through a trapdoor when six months pregnant, there was complete motor paralysis with analgesia below the distribution of the sixth dorsal

nerve Labour came on 261 days after the last menstrual period. The first stage lasted two hours, the second two and quarter hours, and the placenta followed in five minutes. There was no post-partum hæmorrhage. The patient's only sensation during a uterine contraction was a tight feeling in the epigastrium. Death occurred six months later. In Drummond Robinson's case "during some of the uterine contractions the patient experienced a very slight niggling pain, but such a sensation was very occasional, and otherwise the labour was entirely painless."

Pregnancy in paralysed patients must be managed along general lines. There is no indication for premature termination. Cæsarean section at term, followed by sterilisation, is often the best treatment, and the wounds in the uterus and abdominal wall heal satisfactorily.

REFERENCES

- BOYD, W. *Brit Med Jour* 1931 ii, 1087
 BRAIN, RUSSELL. Inheritance of Epilepsy in *The Chances of Morbid Inheritance*. Edited by C. P. Blacker, 1934 Lewis London 73
 COLE R. H. *Mental Diseases*. University of London Press London 1924
 DIMITZ, L. *Beitr z gerichtl Med* 1928 8, 186-204 *Abstr Ber u d ges Gynäk*, 1929 15, 556
 GOBERMAN, A. *J Neuropat u Psychiat* 1927, 20, 195-200 *Abstr Ber u d ges Gynäk* 1927 12, 722
 HUTCHISON and SHERREN. *Index of Treatment by Various Writers* 9th ed., 1926 Wright, Bristol
 JELIFFE and WHITE. *Diseases of the Nervous System* 6th edit 1933
 JONES, R. *Jour Obst and Gyn Brit Emp* 1903 3 109
 LANE ROBERTS C. S. *Lancet*, 1928 ii 1288
 ROBINSON, G. DRUMMOND. *Proc Roy Soc Med London (Sect Obst & Gyn)* 1919
 ROQUES F. *Jour Obst and Gyn Brit Emp* 1928 35 1
 ROUTH, AMAND. *Trans Lond Obst Soc* 1897 39 191
 SCHUMANN, E. A., and FIST, H. S. *Amer Jour Obst and Gyn* 1922 4, 67
 WARE, H. H. *Jour Am Med Assoc* 1934 102, 1833

CHAPTER XXVIII

DISEASES OF THE DUCTLESS GLANDS IN PREGNANCY

Glycosuria and Diabetes

THE mere presence of sugar in the urine during pregnancy is usually of little significance. It may be due to the presence of lactose or to a physiological glycosuria. Very rarely is it found on full investigation to be due to diabetes.

Lactosuria Lactose is liable to be present in the urine at any time during pregnancy, labour or the puerperium whenever the breasts are more than usually active. It is therefore especially likely to be found in the last three or four weeks of pregnancy, about the third day of the puerperium when lactation is being established and at the time of weaning when the breasts become engorged. It may occur alone or particularly towards the end of pregnancy, may be accompanied by glycosuria. It gives the same reducing action with Fehling's solution as glucose and must be distinguished by special tests. Those most commonly used are as follows.

(1) *The Fermentation Test* This test depends on the fact that lactose is not fermented by yeast while glucose is. It is carried out as follows. A mixture of boiled urine and fresh baker's yeast is put into an Einhorn's saccharometer which is then placed in an incubator at 37°C or by the side of the fire for one and a half to two hours. The presence of glucose is shown by a collection of gas (carbon dioxide) at the top of the tube. After fermentation is complete any reducing substance left is lactose.

It is best to put up four tubes as follows: (1) one containing yeast, normal urine and glucose in order to test the activity of the yeast; (2) a tube containing normal urine and yeast to see whether the yeast by itself produces CO_2 ; (3) a tube containing the patient's urine only, to ensure that the urine does not contain organisms capable of producing CO_2 ; (4) a tube containing the patient's urine and yeast.

(2) *The Osazone Test* This test is on the whole simpler and quicker, and gives more definite information. It can also be used for the detection of glucose or lactose when the amount present is so small that it gives an indefinite reaction with Fehling's solution. To carry out the test three or four drops of phenyl hydrazine are

added to about 10 c c of urine in a test tube, together with as much sodium acetate as will lie on the point of a knife. The mixture is then boiled for half an hour and allowed to cool. If glucose is present a crystalline substance is obtained which under the microscope appears as sheaflike bundles of yellow crystals, or more rarely as fairly large rounded yellow masses with a prickly surface (glucozone crystals). Lactozone crystals do not usually appear until the urine has been boiled for a much longer period, say one or two hours. Under the microscope they are recognized by their characteristic yellow "fluffy" hedgehog appearance.

The lactose has been formed from glucose in the breasts. From the breasts it may, in the absence of a free flow of milk, be reabsorbed into the blood, whence it is excreted as lactose by the kidneys. It has been shown that if lactose is injected into the blood stream directly, it appears in the urine as lactose, whereas if taken by the mouth it, after entering the portal circulation, is converted into glucose and is used for the needs of the body.

The presence of lactose in the urine is of no importance and requires no treatment.

Alimentary Glycosuria. A healthy person has an almost unlimited power of storing carbohydrate so that even as much as 400 gm of glucose can be taken without causing hyperglycemia or glycosuria. For some unknown reason but possibly because of increased suprarenal, thyroid or pituitary activity inhibiting the action of insulin, this power is interfered with during pregnancy, and 50 gm of glucose or even less is liable to give rise to glycosuria. This defective assimilation of sugar is found most constantly (about 100 per cent of cases) in the first three or four months, and is usually present from the very beginning of pregnancy. It was therefore proposed a few years ago as a test for early pregnancy, but was soon found to be unreliable, as it is not positive in all early pregnancies, and some conditions other than pregnancy interfere with assimilation of sugar, and therefore give a positive reaction. After the fourth month alimentary glycosuria is less frequent.

Diagnosis. The fasting blood sugar and renal threshold are normal. There are none of the usual clinical signs of diabetes, such as thirst, pruritus, polyuria, etc. In fact, the patient is usually in excellent health, and sugar is only found on routine examination. It is usually slight in amount and hardly ever exceeds 2 gm per cent. A sugar tolerance test, however, shows

the following abnormalities. The curve at the end of half an hour or an hour has risen considerably above the normal threshold (0.18 per cent). Its fall is prolonged so that at the end of two hours it has not yet reached its original level. The curve thus resembles that found in true diabetes. As the latter may, in its early stages, show a normal fasting blood sugar¹ it will be obvious that during pregnancy the condition cannot be distinguished with certainty from true diabetes. The diagnosis can only be made by following up the patient in the puerperium. In alimentary glycosuria the tolerance curve rapidly returns to normal, in diabetes it does not.

While the certain diagnosis of alimentary glycosuria from diabetes may thus be extremely difficult during pregnancy, yet it must be remembered that this condition is very common in pregnancy, while diabetes is rare. Therefore if a pregnant woman has a moderate amount of sugar in the urine and a normal fasting blood sugar, with no symptoms of diabetes even though the tolerance curve shows delayed storage of sugar, the chances are very strongly in favour of the condition being an alimentary glycosuria and not diabetes.

Treatment. None is necessary or advisable.

Renal Glycosuria. In this condition the glycosuria is due to lowering of the renal threshold for sugar. In the normal person sugar does not appear in the urine until the blood sugar rises above 0.18 gm per cent. In renal glycosuria there is an abnormal permeability of the kidney which allows sugar to pass over into the urine at a lower level than this for example at 0.14 per cent. The condition is known to exist apart from pregnancy, and indeed according to Graham is found in 1 per cent. of otherwise healthy people. Pregnancy, however, predisposes to it, and Lambie even goes so far as to say that it is present in 45 per cent. of pregnant women. It may be found at any time but is most common at the sixth or seventh month. Its cause is unknown but there seems to be a family predisposition to it, and it may be combined with albuminuria, with or without hypertension. The sugar may be present in the urine only after meals, in other cases it is present all day. In the former the sugar threshold is fairly high in the latter it is low—probably below 0.1 gm per cent—the ordinary fasting level.

¹ The blood sugar values in this chapter refer to estimations made on capillary blood.

Diagnosis The fasting blood sugar is normal, or may even be considerably below normal, and glycosuria occurs even at blood sugar levels within the normal range. With a sugar tolerance test the curve never rises to the normal threshold level (0.18 per cent), and the blood sugar regains its original level in two hours or less. By careful observation the exact time at which sugar appears in, or disappears from, the urine can be found, and a blood sugar estimation done then will give the renal threshold, which in this case is found to be low. The glycosuria is little influenced by diet, and the usual symptoms of diabetes, such as thirst, polyuria and pruritus, are absent.

Treatment No treatment is required.

Prognosis There is considerable difference of opinion regarding the seriousness of these cases. Many authors think that they may end in diabetes mellitus. In the absence of any definite knowledge regarding the cause of the condition an opinion on the prognosis can be formed only as a result of clinical experience and this is contradictory. Thus several authors (Foster, d'Aprile, Rosenberg, Anderodias and Dubreuil) have reported cases in which an apparently simple glycosuria in pregnancy persisted after delivery, or reappeared in a subsequent pregnancy as a true diabetes. Graham, on the other hand, who has watched cases of renal glycosuria before, during and after delivery concludes that pregnancy has no effect upon it. Labbé says that not a single case of the alleged transformation into true diabetes has been proved. McLean says "that the condition is harmless seems to be proved by the fact that several patients have been examined who are known to have had glycosuria for many years." On general grounds it would appear that this must be the true view, when we consider the frequency of renal glycosuria in pregnancy, and the comparatively few women who suffer from diabetes mellitus during or after child bearing age. In the meantime there is need to examine all cases of glycosuria in pregnancy very thoroughly—quantity of sugar in a 24 hour specimen, blood sugar, and sugar tolerance, and to follow them up in the puerperium. Only by such systematic observations can the data be accumulated that are necessary to enable us to decide finally regarding the prognosis.

Diabetes Mellitus Diabetes tends to cause sterility, hence pregnancy in diabetics is comparatively rare. At University College Hospital there were only six diabetics among 6,500

deliveries between 1927 and 1930. Statistics show that only about 5 per cent of diabetic women of child bearing age conceive. The cause of the sterility is to be found in the changes in the genital organs. Atrophy of the uterus and vagina, and sclerosis of the ovaries with complete disappearance of the follicles and *amenorrhœa* have been described by several observers, and Parisot has produced these lesions in rabbits by an experimental glycosuria maintained for several weeks. Many cases have now been reported in which the menses returned under insulin treatment, in some even after they had been absent for six or seven years (Joslin). It is therefore to be expected that pregnancy in diabetics will be much more common in future than it was in pre-insulin days. Thus Skipper states that in the London Hospital during the years 1893-1932 only 2 per cent of married diabetic women under forty six years of age became pregnant, whereas in the years 1923-1931 15 per cent became pregnant.

Diagnosis. Clinically, there is in addition to the glycosuria, more or less well marked acetonuria, polyuria, thirst, pruritus and wasting. In simple glycosuria these symptoms are usually absent. Estimation of the fasting blood sugar is all important. In pregnant women this is the same as in the non pregnant, namely, 0.09 to 0.11 gm. per cent. A fasting blood sugar of 0.13 gm. per cent is diagnostic of diabetes if such rare causes of hyperglycæmia as hyperthyroidism and infection can be excluded. A normal blood sugar, however, does not exclude diabetes, and in every case where there is a possibility of diabetes it is advisable to do a sugar tolerance test. This test is done on a patient who has had no breakfast. A sample of blood is taken for estimation of the fasting blood sugar. Fifty grams of glucose are then given by the mouth and the blood sugar estimated every half hour for three hours. The highest level of blood sugar reached after giving the glucose should not exceed the normal renal threshold for sugar, i.e., 0.18 gm. per cent., and the original level should be reached in about two hours. If the patient is elderly—over forty—it may take three hours, but longer than this indicates interference with the storage mechanism and is characteristic of diabetes though we have previously seen (p. 441) that it may also be found temporarily in alimentary glycosuria. In the latter, however, the curve becomes normal after delivery. In diabetes the abnormal curve persists. Before carrying out this test it is necessary, as in estimating the fasting blood sugar, to ensure that the patient has

had a full diet for at least two or three days containing a normal allowance of carbohydrates

Every pregnant woman in whose urine glucose is found should have a twenty four hour specimen examined every month and in the last three months, every fortnight, till delivery

Clinical Course of Diabetes in Pregnancy It is well known that in pregnancy there is a special tendency to acetonuria. According to Van Noorden it is present in 30 per cent of normal pregnant women. In the pregnant diabetic this tendency is much more marked and more so even than in the non pregnant diabetic because for some unknown reason pregnancy diminishes the power of assimilating carbohydrates. It is said that this is lower in the first than in the second half of pregnancy because in the later months foetal insulin is available for the mother. In support of this view it has been noted that carbohydrate tolerance diminishes rapidly after death of the foetus *in utero*. Then there are the experiments of Carlson and his co workers. They removed the pancreas from pregnant dogs, and found that as long as the placental circulation remained intact no hyperglycæmia occurred, but that it occurred rapidly after delivery. In a case of twin pregnancy Lawrence showed that while up to the 27th week carbohydrate tolerance deteriorated from the 28th week till the end of pregnancy a great improvement, to the extent of 100 gm of carbohydrate daily, took place, and this increase of tolerance was not maintained after delivery. These facts may have an important clinical bearing for in toxæmia complicating pregnancy in a diabetic woman the foetus is apt to die *in utero*, and coma may be precipitated. It must be said, however, that recent work throws considerable doubt on this view of the importance of foetal insulin to the mother. Skipper reviews the evidence and concludes that although a gain in carbohydrate tolerance sometimes occurs in the latter half of pregnancy "there is no good evidence that this is due to the transmission of insulin from foetus to mother."

Such common symptoms of diabetes as thirst, polyuria, pruritus, loss of strength etc, tend to become worse during pregnancy. But the most characteristic feature is the tendency to a fulminating ketosis. It is almost certain that diabetic coma is due to poisoning by ketone bodies, and consequently during pregnancy there is a special tendency to go into coma. This is most likely to occur during labour, while during pregnancy infective conditions,

such as pyelitis, may precipitate it. In the puerperium there is an increased liability to infection, probably from loss of resistance. The foetus is liable to die *in utero* if there is severe ketosis, and in diabetic coma it practically always perishes. It is then usually retained for a time and is expelled in a state of maceration.

Diabetes and Vulvitis Hesseltine and Campbell have shown that diabetic patients who have vulvitis are invariably infected by vaginal thrush, and that the itching is due to this parasite, *Oidium albicans*, and not to irritation caused by sugar. Its growth is favoured by moist surfaces having an acid reaction and contaminated by glucose. The recognition and treatment of this infection are discussed at p. 538.

Predisposition to Toxæmia in Diabetes There is considerable evidence to show that pregnant diabetics have for some reason a special liability to develop pre eclamptic toxæmia and eclampsia. Priscilla White, reporting on 257 pregnancies in 180 diabetics in Joslin's clinic in Boston, states that the incidence of eclampsia was 5 per cent, compared with 0.3 per cent in all patients. Herrick and Tillman found that in 12 out of 67 pregnancies in 56 diabetic patients the blood pressure ranged from 150 to 180 systolic and from 90 to 120 diastolic. If this is confirmed it is natural to seek the explanation in endocrine changes common to both disorders and we shall see later (p. 451) that attempts have been made to implicate the anterior pituitary gland. Meanwhile it may be observed that the occurrence of toxæmia may be sufficient to account for the frequent occurrence of intra uterine death of the foetus in cases where ketosis is perfectly controlled and thus for the continued high foetal mortality since the introduction of insulin. There seems to be an increased tendency to hydramnios in diabetes, and this is believed to be due to the high concentration of sugar in the liquor amni stimulating the amniotic epithelium to more active secretion. Excessive degrees are less often seen since the introduction of insulin.

Prognosis Before the proper dietetic management of diabetes was understood pregnancy in a diabetic was almost always disastrous for both mother and child. Whitridge Williams, in 1909, collected from the literature sixty-six cases with an immediate maternal mortality of 27 per cent, while an additional 23 per cent died within two years. Matthews Duncan, in 1882, reported in sixteen cases a maternal and foetal mortality of 68

and 47 per cent respectively. The chief danger to the mother is coma. The coma is most likely to come on during labour, probably because in labour there is an increased and imperfect metabolism of fat and consequent increased ketosis. Another cause may be chloroform or ether anaesthesia, both of which lower the carbohydrate tolerance. For the foetus the results in pre insulin days were no more favourable than for the mother, for intra uterine death occurred in half the cases. In Whitridge Williams series above referred to, the foetal mortality was 41 per cent. The foetus might perish *in utero* at any time, but most commonly in the last half of pregnancy, often being retained *in utero* for some time after. Even when born alive and at term, the child had but a slender hold on life, and often died within a few days. It was often unnaturally large and fat and this may have accounted for the high neonatal mortality as it was liable to be injured during delivery. The undue weight is sufficiently accounted for by the maternal and foetal hyperglycaemia (*vide infra*) and the consequent superabundant supply of carbohydrate, though it has recently been suggested (Priscilla White) that it is due to hyperprolanaemia. The cause of intra uterine death was formerly believed to be ketosis but this now seems doubtful.

Since the dietetic management of diabetes has been understood and especially since the introduction of insulin, the outlook for the mother has been transformed. Walker concludes from a review of eighteen cases treated by modern methods that (1) there is now no reason to terminate pregnancy, and no reason why a pregnant woman should not give birth to a living child, (2) there is no special incidence of puerperal infection, and (3) pregnancy does not seem to have any ill effect on the diabetes. Skipper in 1933, collected 118 cases from the literature, all treated since 1923. The maternal mortality was 12.7 per cent and the foetal, including abortions, was 45.2 per cent. In his own series of thirty seven diabetic pregnancies in the London Hospital, though there was no immediate maternal mortality, the foetal was 40.5 per cent. Herrick and Tillman of New York report that in a series of 67 pregnancies in 56 patients, only 38 infants survived the neonatal period (one month after birth). In 11 cases the pregnancy resulted in still birth or neonatal death, in 4 in spontaneous abortion, while in 14 abortion was induced. Johnstone (1935) states that in the last ten years 20 pregnancies in

18 patients in the Edinburgh Royal Maternity Hospital did not result in any maternal mortality, but the foetal mortality was 35 per cent. It appears therefore that though the maternal mortality has diminished almost to vanishing point there is little change in the foetal mortality. The reason for this is not fully known. It was till recently believed that foetal death was due to ketosis and that if this could be controlled the foetus would survive. The occurrence of foetal death however in several cases (see p. 446) in which there was no ketonuria shows that this is not true. It is probable that the explanation is to be found in hypertensive toxæmia to which we have seen that the diabetic patient seems to be especially liable (p. 446).

It is now well established that the islands of Langerhans in the pancreas of the new born infant are hypertrophied as was first pointed out in 1900 by Andérodias and Dubreuil. This is probably due to the high blood sugar in the foetus and the greater call for insulin to deal with it. Its clinical importance lies in the fact that the infant soon after birth is liable to suffer from fatal hypoglycæmia. A close watch should therefore be kept on the blood sugar for some time after birth until the islands readjust themselves and it is a wise precaution to give extra sugar by the mouth for the first month. If the infant is unable to swallow 10 c.c. of a 10 per cent solution of dextrose should be given into the buttock and repeated as indicated by blood sugar determinations.

Skipper like Walker is of opinion that if diabetes is well treated pregnancy has no permanent deleterious effect on the carbohydrate tolerance of the mother. This has also been our experience at University College Hospital.

There is some though not conclusive evidence that congenital abnormalities are unduly frequent in the fetus especially heart lesions, gastro-intestinal atresia and Mongolian idiocy.

The Foetal Blood Sugar. The relation between the foetal and maternal blood sugar is of great interest. There is usually a foetal hyperglycæmia but less than that of the mother. No doubt in the first instance the foetal and maternal blood sugars are equal but the former is subsequently somewhat reduced by the foetal insulin. In a case recorded by Umber in which Cæsarean section was carried out on a comatose woman careful observations were made with the following results. The mother's blood sugar at the time of delivery was 453 mgm per cent. the cord blood

sugar was 275, the liquor amnii sugar 188, and that of the child soon after birth 91. In Lawrence's case Cæsarean section was done on account of severe nephritis complicating diabetes, and binocular twins were born. In the cords the blood sugars were 86 and 68 mgm per cent, and the mother's blood sugar at the time was 150. In a case in University College Hospital the following results were obtained. The mother's blood sugar after delivery was 450, the cord blood sugar was 200, the child's immediately after birth was 150, and the liquor amnii sugar 90. The child weighed 11 lb 9 oz.

The relation between the foetal and maternal blood sugar is of importance in regard to the origin of the liquor amnii—whether it is of maternal or of foetal origin. As the liquor amnii in diabetes contains large quantities of sugar, if the foetal blood sugar were normal the liquor could only obtain its sugar from the maternal blood, and the origin of the liquor amnii from the maternal blood would then be established, though of course the foetal blood would not be excluded as an additional source. As however, there is also a foetal hyperglycæmia no such claim can be made.

Liability of the Child to Congenital Diabetes. There is no risk whatever of this. A few cases have been recorded of glycosuria in the child shortly after birth. This, however, is no evidence of diabetes, but is simply due to the hyperglycæmia present at birth, which passes away very soon. One case, that of Ambard, deserves mention. The mother had severe diabetes in her 8th pregnancy. Labour was induced prematurely. The cord blood sugar was 242 mg per cent and the mother's at the same time was 238. The child lived twenty one hours, and just before death had a glycosuria of 12 parts per 1,000. The pancreas showed inter and intra lobular sclerosis with atrophy of acini the islets being well preserved and numerous. Probably this case was really one of syphilis, as fibrosis of the pancreas is a common manifestation of that disease in the infant, and the previous obstetric history was distinctly suspicious. The question of inheritance of a predisposition to diabetes is considered on p. 119.

Treatment of Diabetes in Pregnancy. While the treatment of the diabetic patient should, whenever possible, be in the hands of a physician the general principles underlying it, which are very simple, should be known to the obstetrician and may be briefly stated as follows. The fundamental fault in diabetes is a failure of insulin which normally keeps the blood sugar at a constant level

by changing part of it into glycogen which is deposited in the liver. Hyperglycæmia therefore occurs if insulin is deficient, and when the blood sugar level exceeds the renal threshold for sugar (180 mg per cent) glucose appears in the urine. Now the complete metabolism of fat depends on an adequate supply of carbohydrate. If the carbohydrate in the diet is insufficient, or what is the same thing, if the carbohydrate supplied cannot be utilised, fat is imperfectly burnt up, and products of incomplete oxidation of fat, viz., acetone and kindred substances, appear in excess in the blood (ketosis) and thence pass into the urine (ketonuria). The aim of treatment is to prevent this ketosis by supplying sufficient carbohydrate in the diet, and by administering sufficient insulin to ensure its utilisation. It should also be remembered that if too much fat is given in proportion to the amount of carbohydrate, there will be a tendency to the excessive and imperfect oxidation of fat and the production of ketosis. Hence it is a principle of treatment that the carbohydrate content of the diet should be high and the fat content low.

Enough insulin, or the more slowly absorbed protamine zinc insulin (which has the advantage of keeping the blood sugar at a more constant level), is given to change the excess of blood sugar into glycogen, but as there is always a danger of giving too much and thus producing hypoglycæmic coma it is a wise precaution to give only sufficient to keep the blood sugar at or just slightly above the threshold level, so that there is always a trace and no more of sugar in the urine. At the same time the fat and carbohydrate content of the diet and the amount of insulin should be so adjusted that the urine is kept free from acetone.

There is as much need as in pre-insulin days for general care, especially rest, freedom from worry, avoidance of chills and exposure to infections which are liable to precipitate coma. A moderate amount of exercise is beneficial, as it helps the metabolism of sugar. From the beginning of pregnancy, the patient should be under the supervision of a competent physician who will co-operate with the obstetrician throughout. At the start of treatment, a week or two in hospital is desirable so that the diet may be properly adjusted. In general, the management follows the same lines as in the non-pregnant diabetic, but the greater danger of ketosis must be kept in mind and the diet so arranged that it is relatively rich in carbohydrate (200 gr carbohydrate) and poor in fat. The urine should be kept

acetone free, insulin being given, if necessary, to accomplish this. It must be carefully watched, especially during the later months, when the urine should be examined at least once a week, and immediately if the patient does not feel well. If the renal threshold is low it may be impossible to keep the urine sugar free without precipitating hypoglycæmia. In these cases the urine sugar should be kept as low as possible by giving the maximum dose of insulin that the patient can tolerate. On account of the great liability to coma during labour, the patient may be prepared for delivery by insulin and covering glucose (20 units of insulin and 40 grams of glucose) given at the onset of labour. A smell of acetone in the breath, drowsiness and most important of all a large amount of diacetic acid in the urine, as shown by a Burgundy red colour with ferric chloride solution, at any time gives warning of impending coma. In such cases energetic treatment must be started immediately. The diet should be stopped, 50 gm of glucose and 25 units of insulin should be given three hourly until the Rothera reaction in the urine is negative. A situation so dangerous for both mother and foetus should, however never be allowed to develop, for the accumulation of ketone bodies in the urine can be recognised in its early stages by the deep purplish blue tint with sodium nitro prusside—the Rothera test. Acetonuria is always an indication that the patient needs more carbohydrate. The diet should therefore be enriched with starchy foods, and if this causes glycosuria the insulin should be increased sufficiently to prevent it.

We have already seen (p 446) that there is considerable evidence to show that the diabetic patient has a greatly increased tendency to develop pre-eclamptic toxæmia and eclampsia. Priscilla White and her co-workers have recently claimed that the toxæmia is preceded and accompanied by a hyperprolânæmia and by a diminished excretion of œstrin and pregnanediol thus supporting the findings of Smith and Smith (p 316) on toxæmia in the non diabetic. By administration of massive doses of œstrin 150 000 to 300 000 I U daily as progynon H and progestin in the form of 10 to 20 mg of proluton daily, they controlled the hyperprolânæmia and reduced their foetal mortality in a series of 9 cases from 30 per cent to 0 per cent. As previously stated (p 316) other workers have failed to confirm the presence of high serum prolân in toxæmia though it is agreed that the excretion of œstrin is diminished. Final judgment on this matter must

therefore in the meantime be suspended. Credit must be given, however, for the excellent results following hormone treatment.

The choice of the method of delivery must be made after consideration of all the circumstances. We have already seen (p 447) that the fœtus is very liable to die *in utero* even when ketosis is controlled. This danger increases as pregnancy advances and is very great after the 36th week. In consequence we now advise Cæsarean section as soon as the child is viable, viz., as soon after the end of the 36th week as possible, in all cases where the mother wants to be sure of a living child. It must be remembered too that the child is often unnaturally large, and this alone may render Cæsarean section advisable. Again, there can be no doubt that the risk of severe ketosis developing during labour, especially if labour is prolonged, is a very real one, and unless the most rigid supervision of the urine can be maintained throughout, the danger of losing the child is so great as to make Cæsarean section a desirable alternative, particularly where the child's life is of great importance, as it so often is in the diabetic. Again, if the patient has the desired number of children, Cæsarean section with sterilization is good treatment, or she may be allowed to go through labour *per vias naturales*, and sterilization may then be carried out at the end of the puerperium. If a general anæsthetic is necessary at delivery, gas and oxygen should be preferred to chloroform or ether, which lower carbohydrate metabolism, and may precipitate coma. Cæsarean section may be carried out under spinal or local anæsthesia.

There appears to be no reason why breast feeding should not be allowed as modern diabetic diets contain adequate amounts of carbohydrate. The special liability to infection in the puerperium must be kept in mind. Hypoglycæmia is liable to occur in the early days of the puerperium, probably from the transformation of glucose into lactose in the breasts. In administering insulin in the puerperium this special danger should not be forgotten. The danger of death of the infant from hypoglycæmia has been already referred to (p 448).

Diabetes Insipidus

This is a rare complication of pregnancy. Recent work by Beattie shows it to be usually due to a lesion in the supra-optic nucleus of the hypothalamus, which has nerve tracts connecting it with the pituitary in the posterior lobe of the pituitary. As

these pituicytes are the source of the anti-diuretic hormone, it is apparent that if they fail to function polyuria will follow. Congenital or acquired syphilis, by causing basal meningitis, may bring about the same result. Pregnancy does not seem to have any influence on the disease, which has usually been established before the pregnancy began, though in a case reported by Gruhinsholz, and in one that occurred in University College Hospital in 1930, the disease appeared to have started during a pregnancy and afterwards persisted. In a case reported by Anselmino and Hoffmann, the disease appeared in two pregnancies and got well in the puerperium, it may have been due to the enlargement of the anterior lobe of the pituitary which occurs in pregnancy, causing pressure on the posterior lobe.

The symptoms are characteristic, enormous quantities—from 25 to 40 pints of pale watery urine of low specific gravity (1001–1005)—are passed, it contains no albumin or sugar. There is excessive thirst and the patient drinks about as much fluid as she passes urine. The thirst and the frequent calls to empty the bladder interfere with rest and sleep, but apart from that there is little complaint, and there is no wasting. Pregnancy continues normally till term, there is no ill effect on labour and the child is of normal size and weight, and does not inherit the disease. In our case there was considerable excess of liquor amni which made it difficult to get about, but this was probably a coincidence.

Diagnosis must be made from hysterical polyuria by the absence of other signs of hysteria, from diabetes mellitus by the absence of sugar in the urine, and from chronic nephritis by the absence of albumin and casts.

Treatment is largely symptomatic. The main object is to control the polyuria so that the patient may have a fair amount of rest and sleep. This is best done by the hypodermic injection of pituitary extract, $\frac{1}{2}$ c c thrice daily, or vasopressin which contains the anti diuretic principle may be used instead if there is reason to fear the oxytocic action of pituitrin. If the patient objects to repeated injections, intra nasal medication may be used instead, and appears to be equally efficacious (Fletcher). A tampon of cotton wool soaked in 0.5 to 1 c c of pituitary extract is inserted into the nostril two or three times daily, or 1 c c of the extract may be diluted with 30 c c of normal saline solution and the mixture sprayed into the nostril several times daily. Bleakely found pituitary snuff (Martindale) satisfactory in a case

under his care. Whatever method is adopted, it is an important practical point to give a treatment just before going to bed, so as to ensure a good night's rest. The anti-diuretic effect of a dose does not usually last for more than four to six hours. Moderate restriction of water intake is advisable, but this must not be overdone. The Wassermann reaction should be taken, and if it is positive, or if there is other reason to suspect the presence of congenital or acquired syphilis, anti-syphilitic treatment should be pushed. Herrick in one case obtained an apparently permanent cure by lumbar puncture and the withdrawal of 5 c.c. of fluid. Premature interruption of pregnancy is not indicated.

REFERENCES

- AMBARD, P, et al. *Bull et Mém Soc Méd des hôpitaux de Paris*, 1923, 49, 547.
 ANDERODIAS, J, et DUBREUIL, G. *Gaz. hebdomadaire des sciences médicales de Bordeaux*, 1921, 42, 2.
 ANSELMINO, H. J., and HOFFMAN, F. *Zentralblatt für Gynäkologie*, 1930, 54, 2061.
 BLEAKELY, J. *Proc Roy Soc Med*, London, 1938, 31, 1062.
 CARLSON, A. J., and DRENNAN, F. M. *Amer Jour Physiol*, 1911, 28, 391.
 CARLSON, A. J., and GLINSBERG, H. *Amer Jour Physiol*, 1915, 36, 217.
 D'APRILE, F. *Jour Obst and Gyn Brit Emp*, 1928, 35, 1910 (Abst.).
 DUNCAN, J. MATTHEWS. *Trans Lond Obst Soc*, 1882, 24, 258.
 FOSTER, N. B. "Diabetes Mellitus." Lippincott, 1915, 99.
 FRUHNHOLZ, et al. *Bull Soc d'obst et de gyn*, 1928, 17, 741.
 FRUTCHER, T. B. *Med Clin N. A.*, May, 1935, 1597.
 GRAHAM, G. *Proc Roy Soc Med London*, 1923-4, 17 (Part 3), 99.
 HERRICK, J. B. *Archiv Int Med*, 1912, 10, 1.
 HERRICK, W. W., and TILMAN, A. J. B. *S G O*, 1938, 66, 37.
 HESSELTINE, H. C., and CAMPBELL, L. K. *Amer Jour Obst & Gyn*, 1938, 35, 272.
 JOHNSTONE, R. W. *Brit Med Jour*, 1938, 1, 765.
 JOSLIN, E. P. "The Treatment of Diabetes Mellitus." Lea and Febiger, Philadelphia, 1928.
 LABBÉ, M. *Ann de Médecine*, 1922, 11, 273.
 LAMBIE, C. G. *Jour Obst and Gyn Brit Emp*, 1926, 33, 563.
 LAWRENCE, R. D. *Quart Jour Med*, 1928-9, 22, 191.
 MACLEAN, HUGH. "Modern Methods in the Diagnosis and Treatment of Diabetes." 4th ed. Constable London 1927.
 PARISOT, J. *Soc Med des hôp de Paris*, 1911, 32, 93.
 ROSENBERG, M. *Klin Woch*, 1924, 3, 11, 1561.
 SKIPPER, E. *Quart Jour Med*, 1933, 26 (N. S.), 353.
 UMBER, F. *Deutsche Med Woch*, 1920, 46, 11, 761.
 VAN NOORDEN, C., and ISAACS, S. "Die Zuckerkrankheit und ihre Behandlung." 8th ed. Springer, Berlin, 1927.
 WALKER, ARNOLD. *Proc Roy Soc Med London* 1927-8, 21, 377.
 WHITE, PRISCILLA, TITUS, R. S., JOSLIN, E. P., and HUNT, H. *Amer Jour Med Sci*, 1939, 198, 482.
 WHITE, PRISCILLA. *S G O*, 1935, 61, 324.
 WILLIAMS, J. WHITRIDGE. *Am Jour Med Sci*, 1909, 1, 137.

CHAPTER XXIX

DISEASES OF THE DUCTLESS GLANDS IN PREGNANCY —(continued)

Diseases of the Thyroid Gland

As was first pointed out by Freund in 1882, enlargement of the thyroid gland is a normal occurrence in pregnancy. Lange (1899) found that of 133 pregnant women the gland was visibly enlarged in 108, and that, of the 25 patients in whom no enlargement was found, 18 developed severe albuminuria. This hypertrophy has by some (Oliphant Nicholson) been regarded as important in protein metabolism, and it has been supposed that the absence of it predisposed to eclampsia. The enlargement, which is diffuse and affects equally all parts of the gland, is not, as was formerly believed, due to congestion, but is a true hyperplasia comparable to that which occurs at puberty, and even during menstruation. The enlargement may be due to the thyrotropic hormone produced by the anterior pituitary, as it has been shown that if this is injected into guinea pigs it can cause hypertrophy and hyperplasia of the thyroid. The enlargement first becomes noticeable about the fourth month, and increases until delivery. In the puerperium it gradually diminishes, and by the fourteenth day the size has usually returned to normal. During pregnancy the basal metabolic rate increases until at the end of pregnancy it may be 20 to 25 per cent above the normal. Possibly some, at least, of the nervous symptoms met with in pregnancy, *e.g.*, tachycardia, insomnia, hypertension, etc., are due to slight hyperthyroidism. It has been suggested, too, that it has some causal relationship to hyperemesis gravidarum.

Exophthalmic Goitre

This disease, at least in its severer forms, is comparatively rare in pregnancy, because of its tendency to cause atrophy of the genital organs and sterility. Croom met with 11 cases in 15,000 deliveries, Meyer 14 in 41,000. In the Mayo clinic there were, from 1916 to 1926, 5,043 women with exophthalmic goitre, and of these 32 were pregnant (0.6 per cent). It is generally agreed that it is more frequent in private than in hospital practice.

Effect of Pregnancy on the Disease It has until recently been

the general belief that exophthalmic goitre was in the large majority of cases made worse by pregnancy. For this belief, Seitz's paper of 1913 is largely responsible. He collected 112 cases from various sources and found that in 40 per cent the disease was unaffected by pregnancy or the puerperium, and even occasionally seemed to be slightly improved. In 60 per cent, however, the symptoms became worse during pregnancy. According to Stowe, the disease may get worse in succeeding pregnancies, or even change its type. He records a case in which the patient had simple goitre in her first pregnancy which grew rapidly in the second and third, and in the fourth took on the characters of true Graves' disease.

Mussey, Plummer and Boothby, from a study of thirty two pregnancies complicated by exophthalmic goitre in the Mayo clinic, concluded that *there is no evidence that pregnancy influences the course of the disease* either for better or worse. Though some of the patients said they felt better during the pregnancy and a few that they did not feel so well, the variations were no greater than one would expect to occur in the disease apart from pregnancy.

Influence of the Disease on Pregnancy There is no evidence that exophthalmic goitre unfavourably affects the course of pregnancy. Of the 32 cases observed in the Mayo clinic, 23 were delivered at term, 2 aborted, 2 were delivered prematurely, 2 were pregnant at the time of writing, and 3 were not traced. One of the abortions occurred at six weeks and the other at three months, seventeen days after a second ligation of the superior thyroid artery. From experience of 18 cases, Clute and Daniels came to the same conclusion, 15 of them had partial thyroidectomy during pregnancy and all went to term and had normal children. The other three also went to term and thyroidectomy was done after delivery. Seitz, on the other hand, concluded that there was some tendency to abortion and foetal death. Among his 112 cases, spontaneous abortion occurred three times, three times a macerated foetus was born, and three times the patient went into premature labour. It is doubtful whether this proportion is higher than might be met with in normal pregnancy. It is said that there is a tendency to premature separation of the placenta and consequent antepartum hæmorrhage (Croom), but even Seitz thinks the risk has been over estimated, and no case occurred in his series.

Influence on Labour The chief danger in labour is heart

failure from toxic myocarditis and to obviate this interference e.g. application of forceps may be necessary early in the second stage Seitz however found that in his series the operative delivery rate was not abnormally high It is said that on account of diminished coagulability of the blood there is a tendency to postpartum hæmorrhage Croom met with severe postpartum hæmorrhage in one of his 12 cases The patient made a slow recovery followed by ovarian and uterine atrophy and permanent amenorrhœa Postpartum hæmorrhage occurred in eight of Seitz's cases but none were fatal From congestion temporary enlargement of the gland often occurs during delivery

Clinical Features The signs and symptoms of the disease are well known and no special description is needed here It must however, be pointed out that in particular cases certain symptoms or groups of symptoms may predominate Thus the effect on the circulatory system may be the most outstanding feature with palpitation tachycardia dyspnoea on slight exertion and cardiac murmurs Again the disease may chiefly affect the nervous system and such symptoms as sleeplessness nervousness or depression of spirits predominate in the clinical picture Or in another the alimentary system may bear the brunt and indigestion vomiting and diarrhœa with emaciation are most marked Hyperemesis may be very severe as in a case reported by Stowe which ended fatally with jaundice and diarrhœa

Diagnosis When the disease is well established this presents no difficulty but the slight cases are liable to be overlooked Nervousness and a tendency to tachycardia and palpitation may be the only outstanding symptoms but there may be functional cardiac murmurs—goitre heart (p. 382) It is probable that slight unrecognised degrees of hyperthyroidism explain the occurrence of the functional cardiac disturbances so often met with in pregnancy It should be remembered that exophthalmos may be absent The eye signs such as those of Von Graefe Möbius etc. with fine tremor exaggerated tendon reflexes and nervousness are all important in diagnosis Glycosuria is not uncommon The basal metabolic rate is important but as there is a 20 to 25 per cent increase in this towards the end of normal pregnancy, it must be greater than that to be significant It is important to note that *the disease may develop for the first time in pregnancy and then is apt to set in suddenly with nausea and vomiting so that it is very liable to be mistaken for hyperemesis gravidarum* This happened in 2 of

Mussey's 32 cases In such cases the vomiting is relieved completely by Lugol's solution

Management during Pregnancy This should be, in the first instance, along expectant lines Diet and hygiene should be regulated, and this is often sufficient to keep the disease in check Absolute rest in the recumbent position and freedom from excitement and worry should be enjoined in the more severe cases Tea, coffee, alcohol and tobacco should be avoided Foods prepared with milk are best, and cereals, eggs, buttered toast or bread may be given Butcher's meat and meat soups should be avoided, but chicken and white fish may be eaten in moderation Improvement may be looked for, or at least the disease may cease to progress in the last half of pregnancy Such drugs as Lugol's solution, m10 twice daily, strontium bromide, pheno barbitone $\frac{1}{2}$ —1 grain three times daily, or quinine hydrobromide gr 10 thrice daily may be tried X rays or radium may be applied to the neck, and occasionally seem to do good Robinson had good results in 15 cases of mild Graves' disease by giving parathyroid and calcium lactate, gr $\frac{1}{10}$ of the former and gr 20 of the latter, each night The improvement during pregnancy was marked and all had normal labours

If progress is not satisfactory, after a fair trial of the treatment outlined above, two courses should be considered, namely termination of the pregnancy or partial thyroidectomy If the foetus is viable, that is over thirty five weeks, induction of premature labour is justifiable This was done eleven times in Seitz's series of 112 cases, 9 of these improved after delivery, one did not improve, and one died Now, however, that subtotal thyroidectomy has become such a safe operation, it is usually preferable, and is certainly the proper line of treatment when the foetus is not viable According to Clute and Daniels, the risk of premature interruption of pregnancy after thyroidectomy is negligible, and it did not occur in any of the fifteen of their cases in which the subtotal operation was performed They state, moreover, that it can be carried out with safety to mother and child One lobe of the thyroid, the isthmus and a portion consisting of one half to one-sixth of the other lobe should be removed A week's rest before operation and Lugol's solution are advisable

Management of Labour Labour is usually uncomplicated Heart failure from toxic myocarditis is the chief danger The indications are to conserve the patient's strength, and to guard

against heart failure and postpartum hæmorrhage. If the second stage is unduly prolonged it may be terminated early by forceps, and if there is dyspnœa, oxygen should be administered. In Seitz's series the frequency of instrumental delivery was, however, scarcely greater than normal.

Effect on the Child. The child is usually born alive and at term. The possibility of a slight increase in the tendency to abortion, to premature labour and to intra uterine death has been already referred to (p. 456). The question of transmission of the disease to the child is of great interest. Seitz states that congenital exophthalmic goitre is very rare, and certainly none occurred amongst his series. Clifford White described a unique case of which the following are the particulars: primipara, aged twenty-three, married ten months, first came under observation at the 5th month of pregnancy when she was found to have Graves' disease. All the symptoms progressively increased as the pregnancy advanced. When admitted in labour the pulse was 120, and the foetal heart beats uncountable, but well over 200. After birth the child's heart rate was still over 200, its eyes were prominent and staring, there was fine tremor of the hands, and a loud murmur was audible all over the præcordium. It weighed 4½ lbs., and lived thirty-five hours. Histological examination of the thyroid showed the changes characteristic of Graves' disease. A year later the patient was again delivered of a dead born child with no abnormalities. There is some evidence that the tendency to Graves' disease is inherited, and according to Gellhorn the tendency is transmitted through the female descendants. He records a case in which the mother had Graves' disease in pregnancy and her three daughters, aged sixteen, fifteen and ten years, developed the disease almost simultaneously.

The Question of Marriage and Pregnancy. If the disease is only slight, marriage and pregnancy may be allowed. If it is fully established it is better to forbid both, at any rate until a cure, partial or complete, has been effected. Berry is emphatic about the advantages of marriage in the milder cases. "In cases of moderate severity," he says, "the disease often comes to an end if the patient marries, and it is my custom, when consulted on this point, to advise that the patient should, if possible, marry. With regard to advanced cases in which secondary degenerations have become established, especially permanent dilatation of the heart, the case is somewhat different. Such cases should be dealt

with as regards marriage and pregnancy on the same lines as other advanced cases of heart disease " Clute and Daniels hold that pregnancy in hyperthyroidism "is an added burden and should be avoided if possible "

Parenchymatous Goitre

Unlike exophthalmic goitre, this disease, otherwise known as colloid goitre," or "bronchocele," is not uncommon in pregnancy, as it has not the same tendency to cause sterility For example Yoakham has recently recorded an incidence of 60 per cent amongst 937 consecutive pregnant patients in the goitre area of Michigan III It must be distinguished from physiological hypertrophy occurring during pregnancy The latter is always uniform but in colloid goitre the enlargement though it may be uniform, may affect one lobe, or the isthmus only A pre-existing colloid goitre usually enlarges, sometimes rapidly, during pregnancy, and does not so constantly undergo regression in the puerperium as the physiological hypertrophy does, or may even continue to develop In spite of the fact that it grows during pregnancy, very few cause troublesome pressure symptoms, the trachea being nearly always able to accommodate itself to the new conditions Of 149 cases recorded by Von Beck 144 were without influence on the pregnancy or labour, though slight dyspnoea often occurred, and there was a tendency to bronchitis Not infrequently in the first half of pregnancy slight thyrotoxic symptoms were observed which disappeared after the fifth month Yoakham found symptoms of hyperthyroidism in thirty five (3.7 per cent) of his 937 patients Rubsamen found injurious effects in seven out of 237 cases Retrosternal goitres are particularly dangerous, and rapid enlargement from hæmorrhage or from inflammatory or malignant changes may cause serious compression or even death from asphyxia but such occurrences are only recorded in the older literature Retrosternal goitre may be diagnosed by X rays, a deep round shadow being seen in the middle line behind the upper part of the sternum Yoakham emphasises the high incidence of congenital goitre in the infant—60 per cent of his cases By giving the mothers 'iodised salt' (common salt containing 0.02 per cent of iodine) in their food he not only caused a prompt decrease in the size of the mother's goitre but also reduced the incidence of congenital goitre to 4 per cent The salt should be taken throughout the entire

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pregnancy in doses of 0.1 mg ($\frac{1}{100}$ grain) daily and is almost useless if only taken during the last three months. Mussey, Plummer and Boothby warn against the danger of giving iodine in appreciable amounts to patients with diffuse colloid goitre, because of the danger of starting hyperthyroidism. "This warning is especially pertinent in cases of pregnancy as the improper use of iodine may force an otherwise avoidable operation at an inopportune time." Should dangerous symptoms develop the choice lies between thyroidectomy and termination of the pregnancy. Usually the former is to be preferred before the foetus has reached viability. Seitz, in 1913, collected fifty-two cases in which the operation had been carried out during pregnancy. The maternal mortality was only 2 per cent, and in three cases (6 per cent) interruption of pregnancy followed the operation. Induction of abortion is generally to be avoided unless thyroidectomy is considered dangerous, though all agree as to the prompt relief that usually follows it. Thus Freund (quoted by Seitz) mentions a case in which after artificial abortion at the third month the swelling entirely subsided. After the 35th week induction of premature labour is usually the best treatment, as operation at that period is liable to bring on labour. Seitz has had experience of two cases in which induction of premature labour was followed by rapid relief of the symptoms.

Management of Labour. The special liability to bronchitis should be kept in mind and precautions taken to guard against it. For example, nitrous oxide gas and oxygen anaesthesia is preferable to chloroform or ether. Dyspnoea or cyanosis may necessitate the use of oxygen. The congestion consequent on the expulsive efforts of the second stage may cause the gland to enlarge perceptibly, and thus increase any dyspnoea already present. Clifford White has recorded a case in which with each labour pain the circumference of the neck increased from 17½ to 19 inches. According to Yoakham, only those goitres that are causing symptoms of tracheal obstruction endanger life during labour by reason of this acute enlargement from congestion. Too powerful expulsive efforts should be discouraged and the second stage may be artificially terminated somewhat earlier than usual. If the dyspnoea is severe, venesection is recommended by Seitz. Finally, the occasional presence of slight thyrotoxicosis and of cardiac changes such as myocarditis, should be borne in mind.

Hypothyroidism

Under this heading may be included (1) myxœdema, (2) cachexia strumipriva (3) endemic and sporadic cretinism. As in all these conditions the genital organs are apt to be poorly developed pregnancy is rare and the opportunities of observing their effect on pregnancy are comparatively few. Myxœdema is made worse by pregnancy the hypertrophy of the gland being probably insufficient to meet the new physiological demands. The œdema of the hands and legs increases as also do the pallor and dryness of the skin but improvement usually occurs in the puerperium. It is alleged by some authors that there is in myxœdematous patients an increased predisposition to eclampsia but this has never been satisfactorily proved and is denied by Seitz.

Mild degrees of hypothyroidism are probably of quite frequent occurrence in pregnancy. Daly and Strouse have especially drawn attention to these cases. They are characterised by minor endocrine disturbances with male distribution of hair excessive fat on the abdomen and hips abnormalities of menstruation and especially periods of amenorrhœa. The basal metabolic rate is low. In pregnancy there is said to be a strong tendency to develop toxæmia with albuminuria and hypertension which can be corrected by thyroid feeding so as to raise the basal metabolic rate 20 to 25 per cent above the initial reading.

Cachexia strumipriva is also aggravated by pregnancy. Abortions and premature births are said to be common, but clinical observations are few and the results of animal experiments contradictory. According to Seitz Schiff and his co-workers found that after thyroidectomy in animals the offspring were rickety and cretinoid. Blumenthal on the other hand found that the young were born dead and Wagner and Schlagenhauser that they were always normal and healthy.

Cretinism is also according to Seitz, made worse by pregnancy though it improves again in the puerperium.

In all three conditions thyroid extract should be started as early as possible beginning with small doses and increasing to the limit of tolerance. Artificial termination of pregnancy because of aggravation of symptoms should rarely be necessary.

REFERENCES

BERRY SIR JAMES (on Exophthalmic Goitre in Pregnancy) Quoted by Berkeley and Bonney "Difficulties and Emergencies of Obstetric Practice" 3rd ed. Churchill London 1921

- CLUTE, H M, and DANIELS, D H. *Am Jour Med Sci*, 1930, 179, 477
 CROOM, J HALLIDAY *Trans Edin Obst Soc*, 1906-7, XXXII, 143
 DALY, P A, and STROUSE, S *Jour Am Med Assoc.*, 1931, 96, 1035
 GELLHORN, G *Am Jour Obst and Gyn*, 1913, 68, 1132
 LANCE, M. *Zeits f Geb u Gynäk*, 1899 40, 34
 MUSSY, R D, PLUMMER, W A, and BOOTHBY, W M *Jour Am Med Assoc*, 1926, 87, 1000
 NICHOLSON, H OLIPHANT *Trans Edin Obst Soc*, 1906 1, 26 184
 ROBINSON, A LEYLAND *Jour Obst and Gyn Brit Emp* 1922 29 290
 RUBSAMEN, W *Archiv f Gynäk* 1912 93, 269
 SEITZ, L *Verhand d deutsch Gesellschaft f Gynäk* 1913 14 15, 213
 STOWE, H M. *Am Jour Obst* 1909 59 789
 WHITE CLIFFORD *Jour Obst and Gyn Brit Emp* 1912, 21, 231
 WHITE, CLIFFORD *Ibid* 1913 24, 271
 YOAHHAM, W A *Am Jour Obst and Gyn* 1928, 15, 617.

CHAPTER XXX

DISEASES OF THE RESPIRATORY SYSTEM IN PREGNANCY

Pulmonary Tuberculosis

With the exception of tubercle affecting the genital tract, especially tubercular salpingitis tuberculosis appears to have little if any tendency to cause sterility, and conception may occur even in an advanced stage of the disease. Few diseases associated with pregnancy are of such general interest, for not only does it present problems that intimately concern the physician, the obstetrician and the pathologist, but the fate of the child is of absorbing interest to the pediatrician and the sociologist.

Incidence The incidence of pulmonary tuberculosis in pregnancy is the same as that in the general population. In University College Hospital there were 82 cases in 16,000 pregnancies during the years 1928 to 1937 inclusive that is, 1 in 200.

Effect on the Mother It is no longer possible to believe that the tuberculous woman is ever beneficially affected by child bearing. According to Rist, recent statistics based on reliable diagnostic criteria, show that almost invariably there is an aggravation of symptoms from flaring up and extension of the existing lesions, and the appearance of fresh ones. Rist followed up 52 patients (from 1919 to 1926) who had tuberculosis when they became pregnant, with the following result. The condition was unchanged in 8 (15.3 per cent), and was worse in 44 (84.6 per cent), death took place after one year in 19 (36.5 per cent) and after two years in 26 (50 per cent). In 2 cases the woman died during the last three months of pregnancy, 1 died in the first week after delivery, and 6 during the first three months after delivery. Of our 82 cases 54 were traced, and of these 24 (45 per cent) were dead in ten years. Of these 3 died before discharge from hospital, 18 died within five years after discharge and 3 more between five and ten years.

The symptoms and signs of an aggravation of the tubercular lesion may appear at any time in the course of pregnancy and a considerable number of cases turn suddenly worse after confinement. Rist says, "There is no circumstance more likely to disturb the healing powers determined by a sufficient air and rest cure, or by a successful artificial pneumo-

thorax than the occurrence of pregnancy . . . " "Many a woman who had the most favourable prospects for making a complete recovery has lost all her chances and has died, because of an intervening pregnancy . . . Conversely, I know of no better criterion of complete and permanent healing of a once confirmed tuberculous lesion in a woman than the fact that she has been able to bear a child without having to suffer from any recurrence of symptoms or signs of her lung disease ' . . . Norris, from a study of sixty eight patients concluded that about 20 per cent of mild quiescent cases of pulmonary tuberculosis and 70 per cent of more advanced cases suffered exacerbation in pregnancy or the puerperium . . . It is only fair, however to state that some other authorities take a less pessimistic view . . . Pissavy and Lejard point out that statistics such as those quoted above should take into account what would have happened if pregnancy had not occurred . . . Forssner's statistics satisfy this condition . . . In comparative tables he sets out the behaviour of pregnant and non pregnant tubercular women between seventeen and forty years of age . . . After two years' observation of 185 tubercular pregnant women it was found that 46 were worse and 49 others dead i.e., 51 per cent unfavourable . . . Of 359 non pregnant patients 80 were worse and 110 dead—52 per cent unfavourable . . . The percentage of unfavourable cases is therefore the same in the two groups . . . Dumarest found that at the end of a year and taking into account cases of medium severity only, the results in gravid tuberculous women were 12 per cent worse than amongst those who had not been pregnant . . . Possibly this is, partly at least due to calcium depletion . . .

The frequency of laryngeal involvement in pregnant tuberculous women has been noted by most writers . . . It may be connected with the fact that normally during pregnancy congestion of the larynx occurs, affecting especially the false vocal cords . . . The prognosis in such cases is extremely grave . . .

As noted above, there is a marked tendency to an acute exacerbation and rapid spread of the pulmonary lesion after delivery . . . This often happens even when the patient has been afebrile throughout pregnancy, when the labour has been well conducted without the help of a general anæsthetic and when there has been no postpartum bleeding . . . The explanation is not clear, but it is probably connected with the lowered resistance following labour, and especially with the renewed mobility of the

diaphragm and lungs consequent upon the evacuation of the uterus Kerley has shown by radiographic examinations that in the later months of pregnancy the right upper lobe is compressed to one third its normal size "The commonest site of cavitation in phthisis is the right upper lobe, and it is obvious that a pregnant patient with a right upper lobe cavity would get selective collapse of her cavity between the fifth and ninth month of her pregnancy. After delivery, the rapid descent of the diaphragm, with full re expansion of the upper lobe, would result in dragging open a partially healed cavity and exacerbating the disease." The risk, therefore may be minimised by artificial pneumothorax at the onset of labour or as soon as possible after delivery

The Placenta in Tuberculosis Schmorl and Geipel examined twenty placentas from tuberculous women Of the twenty, nine placentas were found to be tubercular, of these, five were from advanced cases of pulmonary tuberculosis, one from a moderately advanced case, and one from an early case, one from a case of miliary tuberculosis, and one from a case of tubercular meningitis In only three cases could the diagnosis be made by the naked eye In one, that of miliary tuberculosis there were scattered miliary tubercles all over the placenta, in two others both obtained from severe cases of pulmonary tuberculosis, there were numerous cheesy nodules, the size of a pin head to a pea In the remaining cases the diagnosis could only be made by microscopic examination, and in some as many as 2 000 sections were examined before tubercle could be demonstrated. In the case described by Lanz the patient died with miliary tuberculosis at the fourth month of pregnancy and the placenta showed to the naked eye scattered opaque yellow nodules which were also visible on the membranes—about 1 mm in size Schmorl and Geipel describe the following microscopic appearances in their cases

(1) Tubercular foci in the intervillous spaces and on the surfaces of the villi They consisted mostly of polymorphonuclear leucocytes and lymphocytes or sometimes typical tubercles with giant cell formation, containing numerous tubercle bacilli The epithelium of the villi might be intact and apparently normal, or it might stain badly or even be entirely absent, in which case the tubercular foci rest direct on the villous stroma with no epithelium intervening These foci might extend very widely and so become large enough to include several villi, and then often show caseation in their central parts Schmorl thinks the tubercles originate from the lymphocytes of the blood stream or from the cells of the stroma of the villi Ultimately the included villi become necrotic and permeated by tuberculous granulation tissue—also containing tubercle bacilli The vessels in the villi become obliterated either by swelling of the stroma of the villi, or by proliferation of the epithelial lining, or by formation of a hyaline thrombus Entrance of tubercle bacilli is thus prevented, but not

entirely so, as bacilli could sometimes be demonstrated in the lumina of still open foetal vessels

(2) A rapidly caseating and extensive round cell infiltration in the decidua basalis found principally in the neighbourhood of Nitabuch's fibrin layer and also containing tubercle bacilli. Blood vessels of the decidua lying in these areas have necrotic walls so that they are prone to hæmorrhages which may lead to abortion. In the vessel walls numerous bacilli may be found and a few in the vessel lumen

(3) A third form occurred twice in Schmorl and Geipel's cases. It affected the chorionic membrane and spread from there to the amnion. The tubercles showed the usual histological appearances with epithelioid and giant cells and contained bacilli

(4) Lanz describes similar appearances in the foetal placenta but found no tubercles inside the villi though he found bacilli in the villous epithelium and even inside a vessel in an intact free villus. In the decidua vera he found also typical tuberculous nodules with caseous centre and containing tubercle bacilli. Tubercle of the decidua vera has also been described by other observers

(5) Tubercle bacilli may be found in the placenta without any tubercular lesions (see Whitman and Greene's summary, p. 469)

The method of placental infection is probably as follows. In miliary tuberculosis it clearly comes by the blood stream. In other forms of tuberculosis bacilli may also invade the blood stream especially if the disease is very active with fever. In many of the cases of tubercle in the decidua the tubes were affected and were probably the primary seat. From the tubes a downward spread might occur to the endometrium or deeper parts of the uterine wall. As the decidua is formed from endometrium the existence of foci in the decidua vera and basalis is easily explained. When the tubes are healthy the decidual lesions must be regarded as a blood stream infection. In whichever way the decidua becomes infected we have seen that bacilli may make their way into small decidual arteries lying in the tubercular foci. From thence it may be assumed that they easily make their way into the intervillous spaces and give rise to the tubercles which have been described in these spaces and on the surfaces of the villi. From contact of the tubercles with the villi the epithelial covering (syncytium and Langhans' cells) may degenerate or be completely destroyed and in that way the interior of the villus becomes invaded

Effect on the Fœtus Tuberculosis may be acquired by the fœtus *in utero* in one of several ways. It is conceivable that the bacillus might be present in the ovum prior to fertilisation or in the sperm, or that, if there is tuberculous disease of the male genital tract (tuberculous epididymitis) along which the male cell has to pass, the bacilli might adhere to the outer surface and thus be carried into the ovum. Infection by this route has never been proved, and it is unlikely that an ovum so infected could develop

There is, however, a certain amount of evidence to suggest that infection can take place through the sperm. Thus, several cases have been reported in which the children of a tuberculous father died of the same disease, the mother remaining healthy and contact infection being excluded. Friedmann found that if the testes of animals were injected with tubercle bacilli and the animals afterwards mated with healthy females, bacilli could be found in the seven day embryos without any evidence of disease occurring in the mother.

We have seen that though in tuberculosis of the placental villi a protective obliteration of the foetal vessels in the villi usually takes place this may be incomplete, and bacilli can sometimes be demonstrated in their lumen. Thence they may easily invade the foetal organs, and first of all the liver. Bacilli may invade the maternal blood stream, especially if the disease is very active, and so circulate in the blood in the intervillous spaces. It is doubtful whether they can from there invade the villi through a healthy syncytial covering but it is probable that they may damage the syncytium and thus gain access to the core of the villus, and so to the foetal blood without necessarily causing any histological tubercle in the placenta. Such bacillary spread is most liable to occur in the later weeks of pregnancy, as the disease is then likely to be most active, and at the same time the syncytial covering of the villi is thin, and may here and there be incomplete. It is possible also that invasion at this period is favoured by the fibrin deposits that are laid down on the villi, forming the so-called senile infarcts that are so constantly found in the placenta at term. Leuenberger reports an illustrative case in which the mother died of consumption following spontaneous abortion. Bacilli, but no histological tubercles were found in the intervillous spaces, especially at the edges of the senile infarcts. A few bacilli could be traced through the walls into the capillaries of the villi.

Some authors claim that there is a filtrable form of the tubercle bacillus that may easily pass through even a healthy placenta, leaving no lesion by which its passage may be traced. Such a virus may, in the foetus, give rise to no anatomical tubercular lesion, but the child may be the subject of a 'syndrome of progressive denutrition'. This work, however, requires confirmation.

It is claimed by some observers that infection of the foetus is especially liable to occur during birth, when the uterine contrac-

tions, and the tearing of the placental vessels, are particularly liable to favour the transmission of organisms into the vessels of the umbilical cord. To prevent this Cæsarean section is advised or at least that the cord should be tied as early as possible. That this is not always the method of transmission however, is proved by the fact that several cases are on record of widespread tuberculosis in stillborn fœtuses. In the case of Whitman and Greene the fœtus was stillborn, and there were histological tubercles in lungs, kidneys, adrenals, spleen left ovary, pancreas, brain and placenta. The placenta contained numerous caseous nodules measuring 4 to 5 cm. in diameter. Tubercle bacilli were found in the kidney only. The liver was fatty and contained an occasional small tubercle. The mother at the time of delivery had only a slight lesion—at the right apex. In a case of Couvelaire's the mother was the subject of bony tuberculosis believed to be healed, but she developed tubercular meningitis at the 8th month, and thirteen days prior to the delivery of the child by Cæsarean section. The child was separated from the mother at birth, but lived only nineteen days, and post mortem examination showed tubercular lesions and bacilli in lungs, hilum of liver, spleen, and mesenteric glands.

On the whole, however, the placenta appears to form a very efficient barrier against the tubercle bacillus. This seems strange in view of the great facility with which syphilis spreads to the fœtus, and is only to be explained by the greater invasive powers of the spirochæte. According to Rhenter only about 140 cases of proved congenital tuberculosis are on record—a very small number considering the large numbers of tuberculous women who become pregnant. In 1912 Whitman and Greene reviewed the cases published up to that time—113 in all—and the incidence of lesions was as follows:

Congenital tuberculosis of fœtus and placenta	38
Tubercle bacilli but no histological changes	
Fœtus and placenta	21
Fœtus only	8
Same in fœtus with histological tubercle in placenta	1
Tuberculosis of placenta (bacilli and histological tubercle)	44
Bacilli but no histological tubercle placenta only	3

It is interesting to note the frequency with which bacilli are found in the fœtus or placenta without any anatomical lesions.

Influence of Tuberculosis on the Duration of Pregnancy. It is generally stated that there is no increased tendency to abortion or premature labour. Couvelaire, however, found that there was such a tendency when the mother was the subject of severe acute tuberculosis. Out of 356 gestations observed, 38 per cent. ended in the birth of macerated or very premature *fœtuses*. In the quiet, non febrile types of tuberculosis there would appear to be no such tendency. From a study of 68 cases Norris came to the same conclusion.

Diagnosis of Tuberculosis in Pregnancy. To the obstetrician it is necessary to give a word of warning, viz., that in the early stages of a tuberculous lesion in pregnancy the diagnosis is liable to be overlooked—the poor health, anæmia, etc., being regarded as due to the pregnant state. The acute febrile tuberculosis of the puerperium is likely to be mistaken for puerperal sepsis, especially as up to the time of delivery the temperature may have been perfectly normal, and become elevated for the first time on the 3rd or 4th day of the puerperium. Routine investigation will reveal the true state of affairs.

Management of Pregnancy. As there is fairly strong evidence regarding the deleterious influence of child bearing on the tuberculous lesion it might be expected that there is a clear case for the artificial termination of pregnancy. The problem, however, is by no means so simple. Pregnancy cannot, as a rule, be interrupted without more or less loss of blood, and this is notoriously injurious to the tuberculous patient. It may be said in the first place that if abortion is ever to be induced it should be limited to the first three months, because clinical experience shows that after that period it always leads to an aggravation of the lung lesion. Even Bar, a consistent advocate of the termination of pregnancy in early active but curable cases of tuberculosis, limits interference to the first three months. "Between 3 and 4 months," he says, "the result is doubtful, after 4 months it is bad."

Should Abortion be induced in the First Three Months? In this connection the opinion of Rust is worth quoting. He says "I do not think it has been sufficiently proved at the present time (1927) that abortion is really efficient in arresting the course of tuberculosis of the lungs, determined or aggravated by pregnancy. Some very satisfactory results have been published but they are few in number. For my part I have seen . . ."

influence tuberculosis just as unfavourably as confinement' R A Young says 'In my experience those who see most cases of tuberculosis in pregnancy least often recommend abortion in treatment. He himself had rarely advised it and had generally regretted it afterwards when he had done so

As for comparative figures Czackes (quoted by Pissavy and Lejard) followed up for three and a half years 36 patients on 14 of whom therapeutic abortion had been carried out while 22 had gone to term. Of the latter 12 (54 per cent) were still alive. Of the former 10 (71 per cent) were alive at the end of the three and a half years. The results therefore were 17 per cent better in the series in whom abortion had been induced. Obviously these numbers are too small to be of much value and the results would be much influenced by the degree of severity of the individual cases in each group. But even allowing that the results obtained by induction of abortion are better by 17 per cent, it means that in order to prolong the life of seventeen tuberculous women, 100 infants must be sacrificed which properly cared for, would, in all probability grow up to be healthy adults. Pinard holds that termination of the pregnancy is never justified unless the mother is likely to die during the pregnancy when labour may be induced to save a viable child. Bar on the other hand while admitting that pregnancy should be allowed to continue provided the lesion is healed or if it is so advanced as to be incurable advocates termination of the pregnancy, provided the case is active but in an early and curable stage. It may therefore be said that while the question is not yet finally decided the weight of expert opinion is against therapeutic abortion in tuberculosis. In any case the operation should only be undertaken after the fullest consideration of all the circumstances and after consultation with an expert. The best general anæsthetic is nitrous oxide gas and oxygen, and loss of blood should be reduced to a minimum. Abdominal hysterotomy, preferably under local (p 308) or spinal anæsthesia and with or without sterilisation, may offer the best solution of the problem provided an expert operator is available and no one except an expert should attempt to empty the uterus by any method in such a case. Pinard advocates hysterectomy if the patient has already had a sufficient number of children. He thinks it possible that the consequent amenorrhœa and calcium retention may favour healing of the tubercular lesion.

Should the vaginal route be selected, it is obvious that the

earlier the pregnancy, the less is the risk from hæmorrhage and shock. Should the pregnancy be so early that the patient has not missed more than one menstrual period, the risk may be little greater than that attending an ordinary curettage provided the anæsthetic is properly selected. If in such circumstances the vaginal route is chosen, one or more tents should be placed in the cervical canal eighteen to twenty four hours before the operation without using an anæsthetic. The necessary dilatation of the cervix is thus rendered much easier, and the shock attending the operation is correspondingly diminished. Careful curettage may then be carried out, keeping in mind the danger of perforating the soft uterus, or the ovum may be separated by the finger and drawn out with an ovum forceps as described on p. 179.

Should it be decided to allow the pregnancy to continue, the tuberculous condition should be managed along the usual lines, and sanatorium treatment is usually advisable. Pregnancy is no contra indication to the induction of artificial pneumothorax, and this might be considered in a suitable case, *i.e.*, where the lung lesion is unilateral, and there are no extensive pleural adhesions. During labour loss of blood should be prevented as far as possible, and if an anæsthetic is required gas and oxygen is to be preferred, as ether or chloroform is apt injuriously to affect the lesion in the lung. The excursions of the diaphragm during the second stage of labour may be injurious, so it may be well to apply forceps as soon as the os is fully dilated and the head well down in the pelvic cavity. Instead of a general anæsthetic the perineum may be infiltrated with novocaine and adrenalin. The value of artificial pneumothorax just prior to the onset of labour or immediately after delivery in order to prevent too sudden expansion of the lung has been pointed out previously (p. 466). It should be repeated at intervals during the puerperium. *In the puerperium prolonged rest in bed for at least a month, if possible in the open air, is advisable even though the temperature is normal*, and the child should if possible be entirely separated from the mother from birth and not breast fed. The prohibition of breast feeding is mainly in the interest of the child, in order to minimise the danger of contact infection. Ward has shown that very few of the mothers are injuriously affected by lactation. Out of 831 cases investigated, in 197 the mother breast fed the child for a period varying from a few weeks to over three years, but only in 2 to 3 per cent did lactation appear to cause deterioration in her

health. "Lactation," he says, "may be exhausting, but it may prove more exhausting to get up at night to heat bottles, and to deal with a child made more fretful by artificial feeding." At the same time the possibly injurious effects of calcium depletion on the mother during lactation should be kept in mind. Hunscher, in a study of three nursing women who consumed their usual diets in their homes, found negative calcium and phosphorus balances during the early weeks in spite of large intakes of these substances.

Another pregnancy should be prohibited until the patient has been clinically well, with a normal temperature and absence of tubercle bacilli from the sputum, for at least two years. Rist advises that even then an artificial pneumothorax should be maintained throughout the pregnancy and for six months after. Emile Sergent puts it epigrammatically: "To forbid pregnancy to women with actively progressing tuberculosis is a duty. To authorise it in others is a heavy responsibility, which can only be accepted when for some years the lesion has shown no signs of activity."

The Child of the Tuberculous Mother We have seen above that congenital tuberculosis may occur, though it is probably rather rare, and that premature birth is liable to occur when the tubercular condition in the mother is of the acute febrile rapidly progressive type. Many of these premature children die in the first few days after birth. Couvelaire found that of 356 pregnancies there were only 319 infants (89 per cent.) born alive and so mature as to be capable of surviving and half of these had a birth weight under 3 kilos. Of these 319 47 (14.4 per cent.) died within the first month. These infants had, however in order to avoid infection, been entirely separated from their mothers immediately after birth, and in all probability many of the deaths were due to unsuitable feeding and environment. Improvement in the conditions under which the children were nursed led to a smaller percentage of deaths. Thus of his last series of 111 cases the death rate was only 7.2 per cent. The fatal cases often showed progressive wasting without any definite anatomical lesion demonstrable either ante mortem or post mortem. Nevertheless, tubercle bacilli might be found in the foetal organs, and animals inoculated with filtrates of the organs developed typical tubercle bacilli in the glands. Couvelaire believes that such children are the carriers of a tuberculous virus, possibly filtrable, the presence of which produces no detectable tubercular lesions, either during foetal life or in the early weeks of postnatal life.

Bernard, Debré and Lelong, on the other hand, maintain that the child of the tubercular mother has a normal birth weight. In their series of 265 children the average weight was 3 144 grammes. These children were separated entirely from their mothers immediately after birth and put under the best hygienic conditions as regards nursing, etc. No case of congenital tuberculosis was observed though the children were followed up for four and a half years. They appeared to be in every way normal healthy children requiring and receiving no special care. They did not seem to be more liable than the normal child to contract tuberculosis as they lived the life of the ordinary village child without any special precautions to guard against infection. There was however, as in Couvelaire's cases, a certain mortality due to the artificial nursing conditions. This was only high in the first three months, and in the author's opinion will be remedied by better conditions, after three months the mortality is no higher than for other children. They compare this result with that in sixty six infants of tuberculous mothers left in their own homes. Fifty four (82 per cent) died rapidly, mostly in the first year—the oldest at twenty three months—of pulmonary tuberculosis or tubercular meningitis.

Ward also stresses the risk to the child from leaving it in contact with its tuberculous mother. Of 290 children living with their tuberculous mothers personally investigated by him, 45 per cent were negative, 34 per cent were tuberculous and 21 per cent were suspect. He compares this with the result of the investigations of eighty two controls. Of these 5 per cent were tuberculous, and 8 per cent were suspect. He concludes that *the child of a tuberculous mother, living with its parents, is seven times as likely to develop tuberculosis as the child of a healthy mother*. That this is in all probability a contact infection is proved by the results obtained by Debré and Lelong when the infants were separated from their mothers directly after birth. That the partial isolation ensured by the prohibition of breast feeding while the child continues to live with the parents is of little value, is proved by a further study by Ward, in which he compared the results of breast and artificial feeding on the child. He found that of 177 children breast fed by tubercular mothers 31 per cent were tubercular, while of 116 bottle fed children (living with their parents) 25 per cent were tubercular.

After a study of the whole matter it is difficult to resist the

conclusion that finality has not yet been reached on this question of the frequency and importance of congenital tuberculosis, and its effect on the child. The most recent evidence, however, leads us to believe that its incidence is rare, that, apart from a certain percentage of premature and weakly infants born of mothers in whom the disease has reached an acute phase, the offspring are usually healthy and of normal weight, and most important of all, *if the infants are entirely separated from their parents from birth they are just as likely to grow into healthy adults as are the children of normal parents*. As Rhenter well expresses it "Mais surtout l'enfant né de parents tuberculeux devient malade plus souvent et plus vite parce qu'il est au contact d'une source sans cesse renouvelée, agissante de tuberculose. Qu'on l'isole, il ne s'infectera pas."

Prophylactic Vaccination of the Children of Tuberculous Mothers
Calmette's method of increasing resistance to tuberculosis by the use of B C G vaccine (Bacille Calmette Guérin), an emulsion of living tubercle bacilli which have been so attenuated that they are incapable of setting up tuberculosis, has been and still is used extensively abroad. It has never become popular in this country, partly because it is felt that it has never been sufficiently proved that it is possible to increase resistance to tuberculosis, partly because it is uncertain whether the attenuated vaccine may not revert to virulence. The recent disaster at Lubeck, in Germany in which out of 246 children vaccinated about 50 died of tuberculosis and many others became dangerously ill, shows that such fears may not be unjustified. Griffith, too, found that by B C G vaccine, whether injected or given by the mouth, it was impossible to give complete protection to monkeys.

Influenza

The pregnant woman has apparently an increased susceptibility to influenza, and this susceptibility increases as pregnancy advances. The mild sporadic type of influenza is not usually serious, but it is otherwise with the severe epidemic type, in which pneumonia is exceedingly liable to supervene rapidly. In this severe type, too, abortion, miscarriage or premature labour are apt to occur, and this risk is much greater if pneumonia has developed. Should the pregnancy be thus interrupted, the maternal mortality is about twice as high as if it continues. This is probably chiefly explained by the fact that the more serious the illness the greater is the risk of interruption of pregnancy, but possibly it is

also due to the added strain that labour inflicts on the already overburdened and weakened heart. The more advanced the pregnancy, too, the more serious influenza is whether alone or complicated by pneumonia. Statistics are apt, as usual, to be misleading as they relate to hospital cases, and therefore to the most serious, but Harris from a statistical study of 1,300 cases concluded as follows

- (1) Pneumonia complicated the influenza in about half the cases
- (2) In cases complicated by pneumonia about 50 per cent died, the mortality being somewhat greater in the last 3 months of pregnancy
- (3) The gross mortality of all was 27 per cent
- (4) Pregnancy was interrupted in 26 per cent of the uncomplicated cases and in 52 per cent of the cases complicated by pneumonia. In the cases ending fatally, abortion or premature labour occurred in 62 per cent. Thus in 38 per cent of the fatal cases the patient died without interruption of the pregnancy
- (5) The mortality of influenza was considerably higher (41 per cent) in the cases complicated by abortion or premature labour than in those in which pregnancy was uninterrupted (16 per cent)

Treatment Should influenza develop in pregnancy, the patient should be put to bed at once no matter how mild the attack. Free perspiration should be encouraged by hot bottles and blankets. Aspirin, gr 10, should be given and a hot drink consisting of two tablespoonfuls of whisky in a tumblerful of hot water with sugar to sweeten and drunk as hot as can be borne.

Should signs of pneumonia appear, as indicated by fine crepitations, generally over the lung bases the following mixture should be given at once

R

Pot Iodid	℥ii
Sodii Bicarb	℥ii
Ext Glycerrhiz I iq	℥vi
Aquam ad	℥vi

Solve et fiat mist

Sig One tablespoonful four hourly
et R

Creosote Capsules	iiii
Mitte 12	

Sig One capsule to be taken after each dose of the above mixture

Stimulating expectorants, such as *vinum ipecacuanhæ*, squills, senega or carbonate of ammonia, should be avoided, as they are liable to accelerate the inflammatory process.

With this treatment, "threatening" pneumonia generally fails to develop, or if it has already developed its extent is usually limited, and the prognosis correspondingly improved.

Should pneumonia have already fully developed when the patient comes under observation, the usual supporting treatment is indicated. Morphia should be avoided or given with the greatest care, as it depresses the heart and respiration, and may stop the cough on which the patient depends to remove mucus and muco purulent secretion from the bronchi. Oxygen is advisable if the respiration is much embarrassed. The value of M & B 693 is now so well established that its use should now be almost routine.

Influenza in the puerperium has no special features and its treatment is along the usual lines. Its diagnosis from puerperal sepsis may present difficulty. The pulse is said to be of some diagnostic importance—slow in influenza, rapid in puerperal sepsis (Wallich's sign). Should pneumonia threaten, the prophylactic treatment described above by potassium iodide and creosote should be adopted at once. The prognosis is much worse if the influenza is contracted before or during labour than if it arises for the first time in the puerperium.

Asthma

The cases fall into three distinct groups. (1) Those cases in which the attacks existed prior to the pregnancy but had no special relation to the menstrual cycle. This group includes those directly traceable to sensitisation to pollens. They usually continue unchanged throughout pregnancy but are occasionally aggravated. Green records one and Williamson two fatal cases. (2) Those in whom the attacks were present before pregnancy but only at the time of menstruation. Their ætiology is obscure, but there is reason to believe that they are caused by the absorption of some sensitising product of endometrial disintegration. They cease during pregnancy and lactation, and reappear with the establishment of the menses. (3) Occasionally the attacks are present only during pregnancy, and the patient is quite free between. It may be supposed that in these some sensitising substance is produced by the *fœtus* or placenta. In some of these cases the

attacks only occur during gestation with a male child, while with a female child the patient remains well, or vice versa.

With regard to the outlook for the children, Williamson states that if the mother alone suffers from asthma of the pollen type before pregnancy (Group 1) 38 per cent. of the children develop asthma before the age of ten while if both parents are hypersensitive 72 per cent. of the children are affected. Even before that age the children generally exhibit food idiosyncrasies or a tendency to eczema. There seems to be no special tendency even during attacks to abortion or premature labour. The treatment is that of asthma apart from pregnancy. Termination of pregnancy is not indicated.

REFERENCES

- BAB P. *Bull. Acad. de Med.*, 3^e Serie 1922 88 219
 BERNARD L. *Bull. Acad. Med.* 1922, 88, 579
 BERNARD L. DUBREY, R. and LEJARD M. *Presse Médicale* 1923, 33, 1, 342.
 GREEN BRADFORD. *Jour. Am. Med. Assoc.*, 1934 102, 360.
 GIFFITH A. STANLEY. "Studies of Protection against Tuberculosis—Results with B. C. G. Vaccine in Monkeys. Medical Research Council London Special Report Series, No. 152.
 HARRIS J. W. *Jour. Am. Med. Assoc.*, 1919 72, 9 8.
 HUNCHER, H. A. *Jour. Biol. Chem.*, 1930 86, 37
 KEELEY P. *Brit. Med. Jour.*, 1926 11, 841
 LANT W. *Archiv. f. Gyn.*, 1915 104, 238.
 NORRIS C. C. *Am. Jour. Obst. and Gyn.*, 1916 73, 99
 PINARD A. *Bull. Acad. Med. Paris* 1922 88, 239
 PINSKY A., and LEJARD. *Presse Médicale* 1926, 34 1441
 REINTER J. "La Pratique de l'Art des Accouchements." Broudeau. 4th ed., Part 5 304.
 RUTTER E. *Brit. Med. Jour.*, 1927 11, 247
 SCHNOEL and GRIFFEL. *Munch. Med. Woch.*, 1904 51 1176.
 SERGENT E. *Bull. de l'Acad. de Médecine* 1922 88 604
 WARD E. *Lancet* 1923 11, 557
 WHITMAN R. C., and GREENE, L. W. *Arch. Int. Med.*, 1922, 29 261.
 WILLIAMSON A. C. *Am. Jour. Obst. and Gyn.*, 1930 20 192
 YOUNG R. A. *Brit. Med. Jour.*, 1926, 11, 246.

CHAPTER XXXI

DISEASES OF THE URINARY TRACT IN PREGNANCY

Pyelitis and Pyelonephritis

THE careful study by Gladys H. Dodds (1931) shows that bacteriuria occurs in about 11 per cent of pregnant women, the infecting organism being the bacillus coli in 75 per cent and other organisms in 35 per cent. The female appears to be more liable to urinary infection than the male and pyelitis is much commoner in female than in male children in whom it is comparatively rare. Possibly this is due to the short urethra and to contamination by diapers, clothing, etc. Some observers maintain that in every case of pyelitis of pregnancy there is a history of previous urinary trouble, sometimes dating back to childhood. Whether that is so or not, it is not surprising that pyelitis is one of the most frequent complications of pregnancy, occurring in about 1 per cent. The actual frequency in University College Hospital among the patients attending the antenatal clinic, and excluding any specially referred, was 0.8 per cent. McLane found an incidence of 1.2 per cent in 14,000 deliveries. Of his 168 cases 98 were antepartum, 8 intrapartum and 62 post partum.

Ætiology. The infection may gain access to the kidney pelvis by one of three routes: (1) *From the blood stream.* Blood cultures show that the human blood often contains organisms, which are probably derived from septic foci such as tonsils, teeth, accessory nasal sinuses, appendix, cervix uteri, etc. Most of these are probably killed off before reaching the kidney, but may come to the kidney for excretion. They may be destroyed there by its epithelial cells, or they may damage the epithelial cells and thus pass into the urine. Such damage is in most cases soon repaired, and leaves no discernible trace. If, however, there is urinary stasis they may set up inflammation in the pelvis of the kidney—pyelitis. (2) *From the ascending colon* as it lies in contact with the kidney. This is probably a lymphatic spread, as lymphatic connections have been demonstrated between the ascending colon and the kidney, and they probably exist on the left side also (Francke). The transference of infection is no doubt favoured by constipation. (3) *By an ascending infection from the bladder*

(1) *Pressure by the Uterus on the Ureter at the Pelvic Brim.* The uterus commonly lies slightly over to the right side, and this would account for the greater frequency of pyelitis on that side. Tilting is, however, unnecessary, for apart from it the right ureter is very liable to be compressed between the uterus and the psoas muscle, and in some cases the compression seems to be between the uterus and the common iliac artery, which on the right side, as it has to cross the vertebral column, lies more anteriorly than on the left, and pushes the ureter forward (Baird). The left ureter is less exposed to pressure, for it is protected by the promontory of the sacrum, and, where it passes behind the sigmoid colon and its mesentery the peristalsis of the gut renders the pressure intermittent in character. Pressure cannot, however, be the sole cause, for, as we have seen, dilatation may be demonstrable in the second month.

(2) *Shallowness of the Right Kidney Fossa* (Cabot and Brown). The right kidney fossa is, in women, shallower than the left, and the right kidney is therefore more liable to prolapse, causing kinking of the ureter on that side. There is no doubt that kinking of the ureter is often found on the right side, and the low position of the kidney can then often, but by no means always, be demonstrated.

(3) *Atony of the Ureters* (Vaudescal, Baird). It has been demonstrated repeatedly that there is from the early months, but especially during the last six months of pregnancy, a progressive loss of contractility, which not only in itself is a cause of dilatation, but also predisposes the ureters to dilatation through even slight degrees of compression. After delivery, motility rapidly returns to normal. The cause of the atony has not been determined, but it may possibly be due to the active progestin.

(4) *Hyperplasia of the muscle and connective tissue in the sheath and wall of the ureter* at its lower end, near its entrance into the bladder, has been demonstrated by Hofbauer. The ureter is there converted into a rigid tube, and he believes that this causes obstruction to the outflow of urine. He explains the greater frequency of dilatation on the right side by the right-sided rotation of the uterus, which kinks the lower end of the right ureter, but merely stretches the left. Baird, however, denies that any obstruction is caused in this way, and regards the hypertrophy as a protective mechanism to prevent undue compression of the ureters in the later weeks of pregnancy.

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(5) *Pre existing Ureteral Stricture* (Hunner) According to this view there is in all these cases a pre existing ureteral stricture, possibly congenital, possibly acquired from an old cellulitis or ureteral infection. Hunner believes that the stricture may originate in distant foci of infection, such as teeth or tonsils.

To sum up, it may be said that the two chief causes of stasis in the urinary tract in pregnancy are (a) the atony of the ureter, and (b) compression of the ureters by the pregnant uterus, the first facilitating the second.

Pathological Considerations In the milder cases the infection is confined to the pelvis of the kidney (pyelitis). The mucous membrane is congested and swollen, there is œdema, with round cell infiltration, and patchy shedding of epithelium. In more severe cases the pelvis and calyces are distended with pus containing urine, the pyramids are flattened, and the inflammatory reaction involves the kidney parenchyma (pyelo nephritis). The destruction of the latter may be so extreme that it may contain multiple abscesses, or may even be converted into a large pus sac, with little or no cortical substance remaining (pyo nephrosis). In rare cases a perinephric abscess may form, and point in the loin, or rupture into the peritoneal cavity. Dilatation of the ureter and kidney pelvis is invariably found, and is usually more marked on the right than the left side (see Fig 54). According to Baird it is more marked in primigravidae than in multiparae. It may affect the ureter in its entire length or only the part above the pelvic brim. Bending of the ureter, especially on the right side, is not infrequent and is most commonly found just below the renal pelvis and at the junction of the upper and middle thirds. The causal organism in pyelitis is usually the bacillus coli, but other organisms may be responsible. Of 31 cases examined by Hewitt the organism was bacillus coli in 24 (77 per cent), bacillus coli with streptococci or staphylococci in 6 (19 per cent), and streptococci and staphylococci alone in 1 (3 per cent).

Clinical Features It is somewhat more frequent in primigravidae, and though it may start as early as the second month, is rare before the end of the fourth.

The onset is often insidious, being preceded by headache and malaise. In a few cases it is preceded by symptoms of mild cystitis, and in such it is probable that the infection is an ascending one. For purposes of description the cases may be divided into mild, acute, and subacute.



Fig. 34. Distribution of the right reference of the first gravity

Mild Cases In these the only symptoms may be pain across the small of the back, with or without some frequency of micturition. There may be tenderness in the loin or in the costo vertebral angle, especially of the right side. The condition is liable to be overlooked, or diagnosed as lumbago or the pain in the back may be attributed to fatigue, or to some cause other than the real one. The urine may contain no albumin but examination by the single drop method makes the diagnosis clear.

Acute Cases The onset in these is sudden with nausea vomiting rigors high temperature and rapid pulse and pain distension and rigidity of the corresponding side of the abdomen. At first the pain and tenderness may be diffuse but after a time settle down in the kidney region and are best marked posteriorly in the costo vertebral angle. Not infrequently the pain shoots downwards along the ureter towards the groin, and the ureter where it crosses the lateral fornix may be tender and palpably thickened. There is usually pain and frequency in passing urine due in all probability to reflex disturbance of the bladder. The tenderness and pain in the loin are explained by the tension in the kidney pelvis.

The urine is usually abundant (unless there is pyelonephritis when it may be much diminished) and turbid does not clear on boiling is highly acid when the responsible organism is bacillus coli has a characteristic odour of stale fish and shows on standing a plentiful deposit of pus bacteria transitional epithelium from the kidney pelvis some red blood cells and it may be casts if the kidney parenchyma is affected. From it may be obtained in most cases a pure culture of bacillus coli.

If there is pyelonephritis or pyonephrosis the blood urea may be raised. It should be remembered however that as one kidney alone is usually involved a normal blood urea is compatible with extensive destruction of the affected kidney.

Subacute Cases These are far the most common. They present the same symptoms as the acute but in milder degree. The temperature and pulse are only moderately raised vomiting and rigors may be entirely absent, and pain and frequency of micturition only admitted on close questioning. The most constant and significant sign is the tenderness on deep pressure in the costo vertebral angle. When the condition has lasted for some time there is usually well marked secondary anaemia.

Diagnosis The helpful points are the tenderness in the costo

vertebral angle, especially the right, the pain and frequency of micturition, and the characteristic changes in the urine. It is our experience that these cases are often sent into hospital with a diagnosis of *hyperemesis*, a mistake which of course arises from the frequency and severity of vomiting, or of "*albuminuria*," for which there is less excuse, for the blood pressure is always normal in pyelitis. In mild cases, where nothing may be complained of but pain in the back, the real cause is liable to be overlooked, or the pain ascribed to lumbago.

The Single Drop Method of Examining the Urine The investigation of the urine is all important in diagnosis. Not uncommonly, especially in mild cases, the ordinary naked-eye and chemical examination reveals no abnormality. In the severe cases albuminuria is often present, but it is seldom found in the mild variety. It is necessary therefore to have recourse in all cases to microscopical and bacteriological examination. As about 11 per cent of normal pregnant women have *b. coli* or other organisms in their urine on culture, culture is useless in diagnosis of pyelitis, except as a confirmation of microscopical findings, and in order to reveal the kind of organism present. It has been shown again and again (Hewitt, Dodds) that the most accurate indication of pyelitis is the finding of pus cells and organisms in a single drop of uncentrifuged urine, examined microscopically. The method is as follows. Take a single drop of a fresh catheter specimen of urine obtained in a sterile glass. Do not centrifuge, but put one drop on a glass slide, put on a cover slip and examine with the microscope, using the $\frac{1}{8}$ th objective and manipulating the condenser so that the right amount of light may be thrown on the field. If pus cells and organisms are found, pyelitis may be diagnosed with safety. The examination should, if possible, be made within half an hour of collecting the specimen.

Differential Diagnosis It has been already mentioned that pyelitis is often mistaken for *hyperemesis* or for "*albuminuria*." The diagnosis in either of these cases should present no real difficulty, especially if the possibility of pyelitis is kept in mind, and the urine examined by the single drop method above described.

Appendicitis Pain, rigidity and tenderness in the appendix area may simulate appendicitis, and a retro cæcal appendix may cause tenderness in the loin. The temperature is higher and the general condition is better in pyelitis, but the diagnosis often

remains obscure until the urine is examined. The diagnosis is fully discussed under appendicitis (p 372) It should not be forgotten that, pyelitis being such a common condition, it and appendicitis may exist together

Cholecystitis This usually occurs in fat, middle aged, multiparous women There are pain and tenderness under the right costal margin, and rigidity of the upper part of the right rectus muscle The pain goes round to the back or between the shoulder blades, and jaundice may be present Murphy's sign may be positive and is elicited as follows Press the fingers under the right costal arch and ask the patient to take a deep breath Inspiration is suddenly arrested when the sensitive gall bladder impinges on the fingers

Biliary and Renal Colic In some cases the pain may be so severe and of such a character that it simulates one of these

Pneumonia It is well known that in this condition there may be pain and rigidity in the right hypochondrium Diagnosis is made by examination of the lungs, by consideration of the general condition, and by examination of the urine

Lumbago may be confused with the mild type In pyelitis there may be a history of pain during, and frequency of, micturition, though the urine may appear normal on naked-eye examination, and albumin may be absent In pyelitis, tenderness can generally be elicited in the costo-vertebral angle, and examination of the urine by the single drop method makes the diagnosis clear

Cystitis Pain and tenderness are absent from the costo-vertebral angle, but may be present over the bladder As the infecting organism is often other than the colon bacillus, the reaction of the urine may be alkaline A large quantity of pus and comparatively few organisms favour cystitis rather than pyelitis, and a bacilluria without much demonstrable pus is suggestive of an infection of the renal pelvis A certain diagnosis can only be made, however, by the cystoscope, or, better still, by catheterization of the ureters

Treatment The patient is to be kept in bed on a milk, fruit and carbohydrate diet, and the bowels freely opened The blood urea should be estimated at the beginning of treatment and at intervals thereafter, for a rising blood urea may afford an early indication of renal damage Potassium citrate gr xx-gr. xxx should be given either by itself or combined with sodium bicarbonate, gr xl., every two hours until the urine is alkaline

The administration should be continued at least every three or four hours during the night, for it is then that the urine is most likely to become acid. The treatment aims at making the urine alkaline, and this is facilitated by giving alkaline drinks, such as home made lemonade or barley water, of which at least 5 pints should be taken every day. If as sometimes happens the potassium citrate causes vomiting a good substitute may be found in Tabloid Alkaline Effervescens Co (B W & Co) one being given two hourly. When the urine becomes alkaline (and it should be tested frequently by litmus paper) the condition usually improves, and the citrate and bicarbonate should be given less often—every four hours. When the temperature has been normal for a week the alkalis should be discontinued, and acid sodium phosphate gr xxx , every four hours substituted. The alkaline drinks should now be discontinued and plain water given instead. When the urine has again become acid, hexamine, which in an acid medium gives off formaldehyde, should be given in addition to, and separately from, the acid sodium phosphate. A small dose not more than gr v once daily, should be given to start with and if this causes no exacerbation of symptoms, the dose should be rapidly increased up to gr xv thrice daily. Each dose of hexamine should be given by itself in a glass of water. The reason for starting with a small dose is that some patients display an idiosyncrasy to the drug the temperature, after having been normal for some days, shooting suddenly up to 101° or more, with reappearance of urinary symptoms. For the same reason hexamine should not be started until the temperature has been normal for at least a week. After the temperature has been normal for ten days the patient may be allowed up, but it is advisable to continue the hexamine and acid treatment until delivery.

With these measures most cases do well, at least in so far as disappearance of symptoms is concerned. The temperature falls to, and remains, normal, the pain and frequency disappear, and the tenderness over the kidney can no longer be detected.

A few cases, however, do not improve. The high temperature, pain and tenderness persist, the blood urea may rise, and vomiting set in, or if already present become worse, great prostration, emaciation, and secondary anæmia may follow. In such cases, fortunately rare, recourse may be had to either (1) ureteric drainage with or without washing out the kidney pelvis, or

(2) induction of premature labour It is very important that these patients should not be allowed to drag on indefinitely until irreparable damage has been done to the kidney A careful watch should be kept on the blood urea as a significant increase is an indication of involvement of the kidney parenchyma (pyelonephritis)

Ureteric drainage has been warmly advocated by Russ Regarding the pus in the pelvis of the kidney like a collection of pus elsewhere, he advises drainage by an indwelling ureteric catheter, as large as the ureter will hold It should be passed up to the kidney pelvis and left *in situ* for ten days or longer and the pus aspirated with a 10 c c Luer syringe The catheter is left *in situ* and its end fixed to the thigh by plaster It is inspected by a nurse every hour If not draining properly she injects saline with a 2 c c hypodermic syringe to wash it out, and then aspirates the catheter to ensure drainage The patient should sit up in bed and drink a full glass of water every half hour, the bowels being meanwhile kept freely open Our experience of this method in the few cases in which we have had to use it, has been uniformly favourable

Induction of Premature Labour If facilities for ureteric drainage are not available, or if it fails the only alternative is to empty the uterus This should always be done if the blood urea increases considerably, especially to over 40 mgm per cent or over as the rise is an indication that the kidney parenchyma is involved (pyelonephritis) One of the methods of instrumental induction should be used such as bougie stomach tube or rupture of membranes, and always results in a symptomatic cure

Postural Treatment If we accept the pressure theory of stasis in the ureters a rational treatment would be to make the patient lie on her face, or on her left side and semi prone Occasionally this treatment seems to do good and should always be given a trial in obstinate cases before resorting to drainage

Ketogenic Diet Since its introduction by Helmholtz and Clark in 1931, the ketogenic diet has been largely used in the treatment of the chronic phases of urinary infection It is based on the principle that if the urine can be acidified sufficiently by the presence of ketone bodies, especially β -oxybutyric acid, so that its pH is as low as 5.2, the growth of colon bacilli, and to a less extent of other organisms, is inhibited and the urine rendered sterile The treatment, however, has now been superseded by

on account of the urinary obstruction present during pregnancy this attempt does not often succeed. In a series of thirteen cases, however, Rosenheim obtained sterile urine before delivery in three. After delivery it is successful in the majority of cases—six out of eleven reported by Rosenheim. As the mandelic acid excreted in the urine inhibits the growth of organisms, a patient should not be considered cured until a specimen of urine taken several days after the treatment has been stopped is sterile on culture. If the ammonium mandelate fails to render the urine sterile, urinary stasis should be suspected and pyelograms should be obtained. The only contra indication to the treatment by mandelic acid is a raised blood urea.

Sulphanilamide Excellent results have been reported by Méave Kenny (1937) from the treatment of pyelitis of pregnancy by means of prontosil (*p* aminobenzene sulphonamide). The preparation used was the Bayer product prontosil album, of which one tablet containing 0.5 gm. was given three times daily. In 16 cases the urine became sterile in five to seven days with, at the same time, rapid and apparently permanent remission of the pyrexia and other signs and symptoms. In 6 of the 16 cases however, bacteraemia recurred during the pregnancy but without any relapse of the clinical symptoms. The advantages claimed for the treatment as compared with that by mandelic acid are that it is well tolerated, that it is successful in a larger percentage of cases, that no limitation of fluid is necessary, that it acts more quickly, and that it can be used in the acute stage when the patient is febrile. Prontosil nevertheless, must be used with care as it is liable to produce toxic effects the most noticeable of which are methemoglobinæmia or sulphmethemoglobinæmia which, however, seldom become severe, and some irritation of the urinary tract shown by the presence of granular casts and occasionally red blood cells in the urine. For this reason it is questionable if prontosil should be given when there is evidence of previous renal damage in pregnancy. Cases of agranulocytosis and even of optic atrophy have also been described after it. The drug should, therefore, always be stopped as soon as the urine has become sterile.

Neither saline purgatives nor foods containing sulphur, e.g., eggs or onions, should be given during the treatment. Equally good results are obtained by the use of sulphapyridine (M & B 693), which is less toxic than sulphanilamide.

Prognosis Unless utterly neglected the immediate prognosis

is good. So successful are modern methods of treatment that the mother usually undergoes symptomatic cure and pregnancy continues to term. Of 160 cases of antenatal pyelitis treated in University College Hospital since 1927 only one was fatal. In another a pyo nephrosis developed and the kidney had to be removed after which the patient did well, while the pregnancy continued. A complete cure of the pyelitis during the pregnancy in the sense that the urine becomes sterile is very rare. It only happened twice in our patients and others have had a similar experience. There is a distinct tendency for a spontaneous premature interruption of pregnancy to occur. This took place in 30 per cent. of our cases and is probably attributable to the high temperature. McLane records a maternal mortality of 3.58 per cent. and a foetal mortality of 15.8 per cent.

The remote prognosis is much less favourable. In our series a follow up study after delivery by Gladys H. Dodds before the introduction of mandelic acid or prontosil showed that only 49 per cent. were completely cured in the sense that the urine was sterile on culture. 35 per cent. developed chronic pyelitis and 16 per cent. had continued bacteriuria only. A pyrexia persisting for more than sixteen days was usually associated with a bad remote prognosis for 60 per cent. of such developed chronic pyelitis and in the majority of these dilatation and kinking of the ureters persists and ureteral stricture may develop. In such cases acute pyelitis is likely to recur in succeeding pregnancies but this does not necessarily happen for in our series none suffered from an acute attack in the subsequent pregnancies. 78 per cent. were quite normal in the succeeding pregnancy, while 22 per cent. suffered from chronic pyelitis which had persisted in the interval but which the new pregnancy apparently made no worse. With the use of mandelic acid or prontosil the percentage of cures will probably be considerably increased. As already mentioned (p. 489) Rosenheim obtained sterile urine in six out of eleven patients during the puerperium. The importance attached by Winsbury White to treatment of chronic infection of the cervix has been already referred to (p. 480).

Patients who have had pyelitis in pregnancy should always be followed up in the puerperium and after, and the condition of the urinary tract studied. This involves not only bacteriological examination of the urine but also examination by X rays after intravenous injection of uroselectan to determine whether there

is any permanent dilatation or kinking of the ureters or dilatation of the kidney pelvis. If the blood urea has been raised it should again be estimated. In view of recent work by Peters and others on pyelitis as a cause of permanent hypertension, a watch should also be kept on the blood pressure.

Puerperal Pyelitis

This is one of the commonest causes of puerperal pyrexia, and accounted for 27·5 per cent. of all the cases of the latter in our clinic. Its causes are chiefly two (*a*) catheterisation of the bladder during long labours, and (*b*) imperfect emptying of the bladder in the puerperium from the patient lying on her back, and the loss of tone of the over stretched abdominal muscles. Being an ascending infection from the bladder, both kidneys are usually involved. If the infection has taken place during labour the temperature may be raised on the first or second day of the puerperium but if it has occurred because of residual urine in the puerperium it may not rise till the end of the first week or later. It may be as high as 103°, with or without a rigor, and there is usually some frequency of micturition, but pain and tenderness in the loin are not prominent features, as there is no tension in the kidney pelvis. The infecting organism is often some other than the bacillus coli, and the reaction of the urine may be alkaline rather than acid. *Diagnosis* is made by examination of the urine by the single drop method (p. 484), and the organism is identified by culture.

Treatment is along the usual lines—a mixture containing potassium citrate and sodium bicarbonate, together with copious alkaline drinks, and, when the temperature has become normal, sulphapyridine, to render the urinary tract sterile. This object is usually attained rapidly as there is no urinary stasis.

Hæmaturia of Pregnancy

Hæmaturia of severe degree is a rare occurrence in pregnancy. Kretschmer could only find six cases among 241 cases of hæmaturia of all varieties in women.

It is customary to divide the hæmaturias occurring during pregnancy into (1) those due to lesions in the urinary tract that are associated with, but not caused by, pregnancy, *e.g.*, calculus, infarction, new growths, tuberculosis, etc. (*hæmaturia in pregnancy*), and (2) those due to the pregnancy itself (*hæmaturia of*

pregnancy) It is only with the latter that we are concerned here

The hæmorrhage is usually painless, sometimes profuse and generally recurrent. It seldom comes on before the fifth month, and ceases after delivery, though it may reappear in subsequent pregnancies. Though urologists no longer believe in "essential hæmaturia" *i.e.*, hæmaturia without any lesion to account for it, yet the causal lesion is often difficult to demonstrate. Among the better known causes may be mentioned

(1) *Varices in the Bladder* They may give rise to profuse hæmaturia, and may be accompanied by a feeling of weight and perhaps indefinite aching pain in the region of the bladder. There are often vulval varices present at the same time.

(2) *Chronic Nephritis* Fowler, Balloch and others believe this to be one of the most frequent causes of hæmaturia of pregnancy. The immediate cause of the bleeding is the congestion of the kidney and perhaps the exacerbation of the nephritis which the pregnancy brings about. Hæmaturia may be the first evidence of chronic nephritis, antedating the appearance of albumin and casts by many months, or even by years, and between the attacks the urine may be normal. The disease may therefore be extremely difficult to detect even on macroscopic or microscopic examination of the kidney, or it may on the other hand, as in Fowler's case, have advanced to the stage of the small red granular kidney. The hæmorrhage may be very severe, always ceases after delivery, but often recurs in subsequent pregnancies.

(3) *Ureteral Stricture* Hunner has shown that stricture of the ureter, generally arising from a focus of infection in the teeth, tonsils or elsewhere, is one of the common causes of "essential hæmaturia" and Middleton has also drawn attention to its importance as a frequent cause of hæmaturia of pregnancy, and described four cases. The resulting stasis in the kidney pelvis leads to compression of the kidney substance and interstitial fibrosis, as a result of which certain veins have their lumina narrowed at parts of their course, and become varicose at others and are liable to rupture. According to Middleton the hæmaturia is as a rule, seen only in those multiparæ in whom each pregnancy has left behind a degree of permanent dilatation of the ureter, sufficiently marked to cause stasis in the renal pelvis. The hæmaturia is accompanied by infection in only about half the cases, so that,

though infection is liable to supervene when there is renal pelvic stasis it cannot account for the hæmorrhage. Catheterisation of the ureter and aspiration of the residual urine stops the bleeding though it may recur later.

(4) *Compression of the renal vein by the enlarging uterus* can occasionally lead to hæmaturia by causing stasis in the venous circulation of the kidney. A similar result may follow prolapse of the kidney with kinking of the renal vein.

(5) *In acute pyelitis or pre eclamptic toxæmia* the urine may contain a considerable quantity of blood.

(6) *Purpura lacunaragica*. We have already seen that in this disease bleeding may occur from the urinary tract.

Treatment. It is best to seek the cause and deal with that. If no cause can be demonstrated good results may be obtained from intravenous injection of vitamin C in the form of ascorbic acid in addition to vitamin K (p. 65). In hæmaturia due to purpura vitamin P (p. 397) should be used with vitamin C.

Pregnancy after Nephrectomy

Patients who have had one kidney removed as a general rule pass without disturbance through pregnancy and labour provided the remaining kidney is healthy before the pregnancy starts and is given time for compensatory hypertrophy which generally takes about two years. Indeed if much of the other kidney has been destroyed for some time as may happen for example in unilateral hydronephrosis or in nephrolithiasis the compensatory hypertrophy is often well advanced before the nephrectomy is done.

The prognosis as regards pregnancy is best if the kidney has been removed for such conditions as trauma or a non malignant tumour for then the other kidney is usually healthy. H. B. Matthews summarised 265 pregnancies in 245 nephrectomised women. Only 15 of the 265 pregnancies were complicated by toxæmia, 250 were normal and 2 died. The literature contains numerous records of women with only one kidney who have passed through several pregnancies without trouble.

If the nephrectomy has been carried out for renal tuberculosis the outlook is much less favourable. Crabtree has shown that of 70 cases of renal tubercle treated by nephrectomy 25 had a persistent trace of albumin after the operation and 4 albumin in large amounts the cause of which is obscure but is probably some degree of nephritis of toxic origin. After nephrectomy for

tubercle pregnancy should not be allowed for at least two years and only then if the other kidney is healthy, and there is no evidence of recurrence of the disease elsewhere. After nephrectomy for malignant disease this period should be extended to four years (Kummel).

In all cases of pregnancy after nephrectomy the patient should be kept under careful observation for albuminuria, hypertension, or signs of urea retention. Should signs of toxæmia or pyelitis appear the condition must be promptly treated and the pregnancy should be terminated if it does not clear up in a short time. Should the pregnancy have reached the 36th week it may be wise to do Cæsarean section with or without sterilisation. Apparently such patients stand morphia well, but chloral and the barbiturates badly.

Nephrectomy during Pregnancy

As a rule it is better to tide the patient over till after delivery, but if there is malignant disease or tuberculosis of one kidney it is best to remove it at once. Usually the pregnancy continues till term. Schmidt has collected from the literature 36 cases of nephrectomy during pregnancy, at periods varying from the second to the eighth month. The maternal mortality was only 5·7 per cent (2 cases) and in 77 per cent normal labour occurred at term but in many of the records the effect on pregnancy was not stated and it is probable therefore that the percentage of labours at term was much higher. Theobald has reported four cases. In three the operation was performed between the third and fifth month—twice because of early tubercle and once for Dietl's crisis. None of the patients had subsequently more than the faintest trace of albumin in the urine and the pregnancies proceeded normally to term.

REFERENCES

- BAIRD D. *Lancet* 1932 ii 983
 BAIRD D. *Jour Obst and Gyn Brit Emp* 1935 42 577 and 733
 BALLOCH E. A. *SGO* 1908 6 258
 CABOT and BROWN. Quoted by Keyes in Cabot's *Modern Urology* Vol 2nd Ed. Lea and Febiger New York 1924
 CLARK A. L. *Proc Staff Meetings Mayo Clinic* 1931 6 605
 CLARK A. L. *Lancet* 1932 ii 511
 DODDS GLADYS H. *Jour Obst and Gyn Brit Emp* 1931 38 773
 DODDS GLADYS H. *Jour Obst and Gyn Brit Emp* 1932 39 48
 FERGUSON J. HAIG. *Jour Obst and Gyn Brit Emp* 1907 2 232
 FOWLER H. A. *Johns Hopkins Hosp Rep* 1906 13 487

- FULLER A T *Lancet*, 1933, i, 855
 HELMHOLTZ, H T *Proc Staff Meetings Mayo Clinic*, 1931, 6, 609
 HEWITT, J *Jour Obst and Gyn Brit Emp*, 1923 30 390
 HOFBAUER, J *Bull Johns Hopkins Hosp*, 1928 42, 118
 HUNTER, GUY L *Am Jour Obst and Gyn*, 1925 9, 4~
 KENNY, MÉAVT JOHNSTON, F D HAEBLER, T von, and MILES, A A
Lancet, 1937, ii, 119
 KORNBLUM, *Jour Am Med Assoc*, 1913 60, 1474
 McLANE, CHAS M *Am Jour Obst & Gyn*, 1939 38, 117
 MATTHEWS H B *Jour Am Med Assoc* 1921, 77, 1634
 MIDDLETON, D S *Trans Edin Obst Soc*, 1928 9, 49, 193
 PETERS JOHN P, LAVIETTES, P H, and ZIMMERMAN, H M *Amer Jour
 Obst and Gyn*, 1936, 32, 911
 ROSENHEIM, M L *Lancet*, 1935, i, 1032
 ROSENHEIM, M L. *Lancet*, 1936 ii 1083
 RUSH, J O *S G O*, 1925, 40, 428
 SCHMIDT, L E *S G O*, 1913 21, 679
 SWEET, J E, and STEWART, L F *S G O* 1914, 18, 460
 THEOBALD, G W *Proc Roy Soc Med London* 28, 1935 1397
 VAUDESCAL, R, DE BEAUFORD, F, and PORCHER P *Gynéc et obstet Paris*,
 1927, 16, 420
 WINSBURY WHITE, H P *Brit. Jour Urology*, 1933, 5, 249

CHAPTER XXXII

AFFECTIONS OF THE SKIN IN PREGNANCY

Pigmentation

THIS well known phenomenon is in all probability due to expansion of the melanophores or pigment bearing cells of the skin by a hormone derived from the posterior lobe of the pituitary. It is usually said to be more marked in brunettes than in blondes but Ballantyne and Browne have shown that complexion actually makes no difference to its intensity. The most distressing part of it is the chloasma—a diffuse or circumscribed pigmentation of the face of yellowish or bronze tint which sometimes resembles a mask. Fortunately, although the pigmentation of the nipples and breasts (primary and secondary areolæ) tends to persist to some extent the chloasma almost always disappears completely after pregnancy is over. Brickner has described pigmentation of the nails especially of the index and middle fingers, but this is exceedingly rare. It is said that birthmarks often undergo enlargement during pregnancy.

Striæ Gravidarum

These may be found in the later months of pregnancy on the abdomen particularly in the area below the umbilicus and in the flanks on the breasts especially the lower and inner quadrants, on the upper and outer parts of the thighs and occasionally on the buttocks. In about 20 per cent of cases they are entirely absent. Histologically it has been shown that the elastic fibres of the cutis are torn asunder, so that under the striæ they are entirely absent while at their sides they are heaped up.

Factors favouring their production are great increase in size of the uterus obesity and especially the rapid deposit of fat under the skin which so frequently occurs during pregnancy. Hence they are more likely to be marked if the child is large and if there is hydramnios or multiple pregnancy. They rarely appear before the fifth month and usually not before the sixth or seventh and after pregnancy lose their pink colour become pale and persist permanently as the *lineæ albicantes*.

Much may be done to prevent their formation by massage of the skin for about 15 minutes daily with some lubricant, such as vaseline, olive or linseed oil or glycerine. This may best be

done by picking up successive folds of the skin of the abdomen between the finger and thumb and rubbing it gently to and fro. The wearing of a well fitting corset to support the abdomen without compressing it (p 75) is an additional preventive.

Herpes Gestationis

This is a bullous eruption allied to dermatitis herpetiformis. It may appear in a first and in every subsequent pregnancy, or for the first time in a third or fourth or again it may occur in one pregnancy miss another or two and reappear in a still later one. Usually it begins about the fourth or fifth month continues till term and disappears in the second or third week of the puerperium.

Clinical Features It usually affects the chest, abdomen, arms and legs (Fig 55). There are erythematous patches varying in size from a six pence to a crown piece or larger which tend to heal in the centre and spread at the periphery. On the margins of the patches vesicles form, containing clear fluid or more rarely pus, the bullæ varying in size from a match head to a hazel nut. When the bullæ rupture they leave raw areas, and, if they are purulent sticky impetiginous crusts. The chief symptom is itching which is often intense, and as it prevents sleep it may ultimately result in great prostration.

Diagnosis In pemphigus the mucous membranes are often involved, and the vesicles are thin walled and arise on healthy skin or mucous membrane. Herpes appears on skin surfaces



FIG 55 Herpes gestationis

only, and the bullæ are thicker walled, and arise on already erythematous patches, usually at their margin. Itching is a prominent symptom absent in pemphigus. In erythema multiforme the bullæ are at the centre of the erythematous patches, itching is less marked, and the condition responds to salicylates.

Treatment The most effective treatment is by the serum of a healthy normal pregnant woman, 25 c c of which should be injected into the subcutaneous tissues at intervals of 1 to 7 days. This usually brings about rapid improvement. If fresh serum is not available horse serum may be used instead. If these fail, Ringer's solution, 200 c c, should be tried. Howard advocates potassium arsenite internally in full therapeutic doses or, still better, administered in intermittent courses and, after incision of the bullæ, baths containing Condy's fluid. A 5 per cent solution of gentian violet should then be applied to the raw areas. X-rays sometimes seem to benefit, especially in relieving the itching. In intractable cases it may be necessary to terminate pregnancy.

Subcutaneous Hæmangio-Endotheliomata

These tumours may arise *de novo* in pregnancy or as a rapid increase of a pre-existing nævus. That they are not uncommon is shown by the fact that Davis, whose excellent paper on the subject should be consulted for full details, was able to collect eleven cases from antenatal clinics in two years. They are usually single, present as a pigmented warty subcuticular growth, and while they may appear on any part of the body are most commonly found on the face, especially on the area of the chloasma. The growth is not painful but may be tender, and while usually innocent may be locally infiltrative. Histologically it consists of a large number of small vessels lined by hypertrophic and neoplastic endothelium, but why it should arise during pregnancy is unknown. It usually starts about the 5th or 6th month of pregnancy, and continues to grow very slowly till about three months after delivery and then gradually regresses, occasionally it disappears completely, but as a rule a small residual wart remains. No treatment is required except in the infiltrative type when it may be necessary to dissect the tumour out. As there is a thin capsule this is not difficult to do.

Eczema

Eczema in pregnancy may be localised or very widespread, as in a case recorded by Gellhorn, where the entire body, including

the face and external genitals, was covered by thick crusts. The itching may be very severe and entirely prevent sleep. In addition to the usual external applications, such as Lassar's paste, subcutaneous injections of the serum of a normal pregnant woman, 25 c c once or twice weekly, or horse serum, or 200 c c Ringer's fluid should be tried. The danger of Cæsarean section in infected skin conditions, especially if they involve the abdomen, should be borne in mind.

Molluscum Fibrosum Gravidarum

This condition was first described in 1906 by Brickner, who had observed 19 cases. Small sessile or more frequently pedunculated growths, ten to forty in number, and varying in size from a pin head to a split pea, appear from the fifth month of pregnancy onwards, about the neck, or between and below the breasts. They are not painful or tender, may or may not be pigmented, and are accompanied by no other symptoms. Histologically they are soft fibromas, innocent in nature, covered by squamous epithelium and are allied to molluscum fibrosum as it occurs apart from pregnancy. They usually disappear in the puerperium but in some instances they may remain indefinitely, some of the growths retaining their pigment, others losing it.

Itching of the Skin

A generalised itching all over the body is not uncommon in pregnancy. It is usually slight and intermittent, but is liable to be worse at night, and may seriously interfere with sleep, and cause great depression and ill health. It is believed to be due to a circulating toxin which irritates the nerve endings in the skin, but the origin of the toxin and its nature are unknown. Itching of the skin is a well known symptom of glycosuria and diabetes, and it may occasionally occur in chronic nephritis, or in jaundice, and intestinal derangements too, especially constipation, may give rise to or aggravate it.

Treatment The urine should be tested for sugar. If there is constipation, calomel at night, followed by a saline in the morning, is indicated. Sedatives, such as sulphonal, medinal, chloral or bromides, should be avoided unless there is intractable insomnia, antipyrin in 5 grain doses may, however, be given, and often brings relief. A hot bath at night with 2 lbs of brin or oatmeal

added is soothing and may ensure a night's rest or 2 oz of bicarbonate of soda to a hot bath of about 30 gallons of water may be equally effective. The skin may be bathed frequently with cooling evaporating lotions such as Eau de Cologne or lavender water or with antipruritic lotions such as carbolic acid 1 in 40 or liquor carbonis detergens 1 in 20 and a dusting powder composed of zinc oxide with 10 per cent camphor added and applied to the skin after drying is often soothing. Irritating articles of clothing should not be worn next to the skin.

Pruritus Vulvæ This troublesome complaint is generally caused by some irritating discharge such as leucorrhœa arising from cervicitis trichomonas or thrush or by sugary urine. Rarer causes are diseases of the vulva such as eczema kraurosis (rare in women of child bearing age) leukoplakia or varicose veins.

Treatment The first essential is to search for a cause and treat that. Discharge should be sought for and treated and the urine should always be tested for sugar. In addition to treating any such local cause the following remedies may be used to relieve the intolerable itching.

(1) Bathing the vulva with cold alkaline solutions such as that made by dissolving baking soda or washing soda in cold water and after drying dusting with calomel powder or with a powder composed of zinc oxide to which 10 per cent of camphor has been added.

(2) Liquor carbonis detergens 1 in 20 or carbolic acid 1 in 40. These lotions are best used cold and at night before retiring.

(3) Ungt Resorcin Co may be applied to the vulva or the following.

R

Menthol

Acid. Carbolic

aa gr xxx

Zinc. oxid.

℥ii

Paraff Moll Alb

ad ℥i

Fiat ungt

Friedrich obtained prompt relief by œstrin in two cases of pruritus vulvæ. He gave 0.000 I U hypodermally three times a week. Such treatment is not irrational as it has been shown (Cohen, Marrian and Watson) that 90 per cent of the œstrin excreted in the urine in pregnancy is in a combined physiologically inert form.

REFERENCES

- BALLANTYNE, J. W., and BROWNE, F. J. *Trans. Edin. Obst. Soc.*, 1919-20
40, 74.
- BRICKNER, S. M. *Amer. Jour. Obst.*, 1906, 53, 191.
- BRICKNER, S. M. *Trans. Amer. Gyn. Soc.*, 1919, 38, 601.
- COHEN, S. L., MARRIAN, G. F., and WATSON, M. *Lancet*, 1935, i., 674.
- DAVIS, ALBERT. *Jour. Obst and Gyn Brit Emp.*, 1938, 45, 667.
- FRILDRICH, H. *Zent f Gynak*, 1938, 62, 1289.
- GELLHORN, G. *Am. Jour Obst and Gyn*, 1933, 26, 408
- HOWARD, R. L. *Archiv Dermat and Syph*, 1933, 28, 782.
- TAUSSIG, F. J. *Trans Amer Gyn. Soc.*, 1913, 38, 343

CHAPTER XXXIII

TUMOURS COMPLICATING PREGNANCY, LABOUR AND THE PUERPERIUM

Fibroid Tumours of the Uterus

FIBROID tumours of the uterus are not infrequently met with during pregnancy. Their frequency is usually stated as about 1 per cent. but this figure is certainly much too high. In University College Hospital only one case occurred in 350 amongst booked cases from our own district i.e. 0.28 per cent. They are hardly ever met with before the age of twenty-five and most of the patients are over thirty-five. They are most common in elderly primigravidae.

General Considerations. The fibroids may be either submucous, interstitial or subperitoneal. Pregnancy is probably rare with submucous fibroids but it has been known to occur and even to proceed to term though it is extremely likely to end in abortion. Subperitoneal fibroids have little tendency to cause abortion and may interfere but little with uterine action during labour but are as liable as the others to undergo red degeneration, while if the pedicle is thin it may undergo torsion. They are if in the pelvic cavity at the start of labour, extremely likely to cause obstruction. Interstitial fibroids especially if numerous are apt to cause abortion and during labour may interfere seriously with the power of the uterus to contract and retract. Cervical fibroids almost invariably prevent dilatation of the cervix, especially as unlike those situated in the body of the uterus they are not drawn up out of the pelvis during pregnancy.

Influence of Fibroids on the Pregnancy. Fibroids especially if small commonly give rise to no symptoms whatever during pregnancy, and may even cause no trouble in labour or the puerperium. It is sometimes asserted that they may predispose to ectopic gestation by interfering with the passage of the ovum along the tube. Troell in 1910 found 49 cases recorded in which fibroids and tubal pregnancy co-existed. Considering the frequency of tubal gestations and also of the association of fibroids and pregnancy it is not surprising that the two conditions should sometimes exist together but it is unlikely that there is any ætiological connection between them. It is also asserted that they cause placenta prævia but this again is doubtful. Olshausen

quotes Nauss as finding only 2 cases among 241 of fibroids complicating pregnancy, and Watson had only 1 case among 157.

Premature Interruption of Pregnancy There seems to be an increased tendency to abortion or miscarriage, especially after the third month. This is probably due to mechanical interference with the growth of the uterus and is greatest when the fibroids are submucous or interstitial. Amongst 191 cases Pierson found that two aborted spontaneously in the first three months, between the end of the third and the twenty eighth week miscarriage occurred twenty times, and between the twenty eighth week and term premature labour set in nineteen times. Thus in 39 (24 per cent) the pregnancy ended prematurely. The tumours were considered to be the cause in 16 per cent. Pinard had 14 abortions among 84 cases (15 per cent).

Pressure Symptoms Large fibroids situated above the pelvic brim may cause considerable discomfort by their mere bulk especially near term, when the uterus is already stretching the abdominal wall. It is remarkable, however, how well the abdomen accommodates itself, even to very large fibroids, so that serious discomfort or pressure symptoms from tumours in this situation are rare. But it is otherwise with fibroids situated in the pelvis. Usually these are drawn upwards above the pelvic brim as pregnancy advances, but sometimes this does not occur, and as the tumour increases in size it may become impacted in the pelvis and give rise to serious pressure symptoms—on the bladder, urethra, (causing acute retention of urine) rectum or pelvic veins. Such symptoms generally demand immediate operation, with removal of the impacted tumour.

Torsion of the pedicle of a subperitoneal fibroid is a rare occurrence. The torsion may be transmitted to the uterus, and Troell gives a list of twenty one cases of uterine torsion from this cause. The symptoms are acute, with pain, vomiting, distension and dehydration, and the only treatment is immediate laparotomy.

Effect of Pregnancy on the Fibroids *Increase in Size* This is due partly to œdema of the tumour, partly to hyperplasia of its muscle fibres, comparable to that occurring in the muscle of the uterus. The œdema leads to more or less softening.

Upward Displacement As pregnancy advances the tumour tends to be drawn upwards out of the pelvis. Because of the enlargement of the tumour and its upward displacement, it may

become clinically evident for the first time during pregnancy. As the uterus in the last three months becomes thinned out small fibroids deeply sunk in its wall and therefore hitherto impalpable may be projected towards the peritoneal surface and thus become palpable for the first time. On the other hand large fibroids may become so flattened out and softened that their outline becomes less definite or the tumour may even become quite impalpable.

Red Degeneration In pregnancy and the puerperium there is an increased tendency to red degeneration possibly because of an increase of the fibrinogen content of the blood rendering it more liable to clot. Thrombosis occurs in vessels supplying the tumour and in consequence its blood supply is cut off. The empty capillaries as in infarction elsewhere become engorged with venous blood, rupture and the tumour becomes stained by extravasated blood so that on section it looks like raw beef. Finally necrosis sets in followed by liquefaction in the infarcted area. The centre of the tumour is then occupied by greyish necrotic material surrounding a central cavity filled with fluid. Usually this fluid is sterile but it may become infected from the intestine or elsewhere. This liquefactive process probably takes many months and at term fluid may be found in the centre of a fibroid that had been observed to undergo red degeneration in early pregnancy.

Symptoms of Red Degeneration in Pregnancy There is abdominal pain not usually very severe. The temperature may or may not be slightly raised but hardly ever exceeds 100° unless the tumour is becoming infected which is very rare. One or more of the fibroids are tender on pressure. Occasionally the symptoms may be very acute with severe pain, high fever, vomiting, dehydration and distension—in fact all the signs of an acute abdominal crisis.

Treatment of Red Degeneration in Pregnancy The attacks are nearly always mild and respond well to expectant treatment—bed, mild purgatives and if necessary to relieve the pain ice bags on the abdomen and analgesics such as aspirin or morphia. Usually the symptoms only subside slowly and the patient must be prepared to stay in bed or at least at rest in the recumbent position for three to six weeks. Occasionally the symptoms starting in early pregnancy persist in a subdued form until delivery necessitating rest throughout all the later months. There is no need in these mild cases to resort to either hysterectomy or myomectomy.

In the occasional severe case in which the patient, as described above, presents all the signs of an acute abdominal emergency, there is no choice (especially as the diagnosis is often in doubt), except immediate laparotomy. Myomectomy should usually be preferred to hysterectomy, especially if the patient is a *primigravida* or has no living child. The operation is ideal if there is only one fibroid situated in the superficial part of the wall of the uterus or if the fibroid has a pedicle. A fibroid shells out easily from the wall of the pregnant uterus leaving a bleeding bed which should be obliterated by mattress sutures. Occasionally it may be impossible to control the bleeding on account of the tension of the pregnant uterus. In such cases it is better to remove the ovum by hysterotomy, after which control of the hæmorrhage is easy. This is better than sacrificing the uterus by hysterectomy as has been sometimes done unnecessarily in such circumstances.

After myomectomy there is a great tendency to abortion, especially if the uterus has been much handled during the operation, or if the tumour has been deeply situated. The experience of Landau with only one abortion in eleven myomectomies was unusually favourable. In order to minimise the risk it is important to handle the uterus as little as possible during the operation and to keep the patient under morphia for a week after it.

Influence of Fibroids on Labour. They tend to cause malpresentations. Olshausen found that in 304 cases the presentation was vertex in 54 per cent, breech in 24 per cent and transverse in 10 per cent. Even when the presentation is vertex fibroids in *primigravidae* often prevent the entry of the foetal head into the pelvic brim in the last weeks of pregnancy. The frequency of premature labour has been already referred to. When the fibroids occupy the pelvis they tend to obstruct labour and thus increase the frequency of operative delivery. We have seen that fibroids occupying the pelvis in the early weeks of pregnancy tend to be drawn upwards as pregnancy advances. Tumours therefore, that in the first three months seemed certain to obstruct labour, often give rise to no obstruction whatever, as at term they lie entirely above the pelvic brim. During the second stage of labour a tumour in the lower uterine segment may also be drawn upwards above the presenting part, but only if it is situated in the anterior or lateral walls. A cervical fibroid even though small almost invariably interferes with dilatation of the cervix and therefore causes insuperable obstruction.

begun in pregnancy may continue into the puerperium. After delivery the fibroids usually diminish rapidly in size, though it is doubtful if they ever entirely disappear.

Diagnosis in early pregnancy may be very difficult. Usually the patient is a primigravida over thirty five. Amenorrhœa is important. Breast signs are often helpful as the patient has not usually been pregnant before. Fibroids may be associated with secretion in the nipples, but they never cause pigmentation. Fibroids do not cause softening of the cervix though if erosion is present at the same time it may be simulated. The pregnant uterus containing fibroids is larger than the period of amenorrhœa would lead one to expect and the surface may be irregular and nobby. The Zondek Aschheim test is invaluable and after the 16th week X rays may show the foetal skeleton. In the later months there is as a rule little difficulty in recognising the fact of pregnancy as the foetal heart sounds, foetal parts and movements and external and internal ballotement come into the picture. The fibroids, because of their softening often become less distinctly palpable at this time, on the other hand, small fibroids not formerly felt, become, by the stretching of the uterine wall, projected towards the surface and thus may be recognisable for the first time.

Treatment. Most cases need no treatment whatever during pregnancy, and proceed to term without any disturbance. All pregnant patients with fibroids should, however, receive careful supervision. Red degeneration is the most frequent cause of trouble. The symptoms and treatment have been already discussed. On account of the risk of abortion it is advisable that the patient with fibroids should rest in bed if possible, at the times at which her periods would have occurred if she had not been pregnant. Threatened abortion should be treated along the usual lines (p. 172). If abortion takes place myomectomy may be advised and should be carried out when involution of the uterus is complete. Pregnancy should be avoided for a year after it.

Occasionally a patient in the early weeks of pregnancy has a fibroid so large that it is considered impossible for the abdomen to hold a full time foetus as well as the fibroid and it may then be advisable to perform myomectomy as early in the pregnancy as possible. The fibroid in these cases is often single and pedunculated and is easily removed without risk to the continuance of the pregnancy.

not till the puerperium is past, lest an infected uterine cavity be opened during the operation. As an alternative to this treatment Cæsarean section without myomectomy may be carried out at term.

If there are fibroids in the pelvis Cæsarean section may be done at term, or if the tumour is situated in the anterior or lateral wall of the uterus the patient may be given a trial labour. After the os is fully dilated, the fibroid may become drawn up out of the pelvis above the presenting part. If this does not happen Cæsarean section should be carried out, preferably the lower segment operation. It should not be forgotten that cervical fibroids often interfere very seriously with dilatation and Cæsarean section is then the best treatment. Sometimes it may be possible to push up an obstructing pedunculated fibroid during labour, thus allowing the head to pass.

It may be well to emphasise the following points —

(1) Fibroids situated in the lower part of the body of the uterus are generally drawn up above the pelvic brim during pregnancy and therefore do not often give rise to obstruction in labour. The same may occur in the second stage of labour if the fibroid is not situated in the posterior wall of the uterus.

(2) Red degeneration is the commonest complication of fibroid tumours in pregnancy. Usually it is of mild degree and subsides with expectant treatment, the pregnancy continuing.

(3) Choice of method of delivery depends on the age and parity of the patient, and on the situation of the fibroids. In young primigravidae, in multiparæ who have healthy living children and even in elderly primigravidae where there is no other obstetrical abnormality, a trial labour should be considered.

Ovarian Tumours

It is often alleged that ovarian tumours cause sterility. Simpson reckoned that 1 in every 10 married women was sterile, but of those who had ovarian tumours 1 in every $3\frac{1}{2}$ was sterile. Dieulafoy records 42 cases of sterility in young women with unilateral cysts of the ovary, and 33 of these became pregnant within three years after ovariectomy. Notwithstanding ovarian tumours are often met with in pregnancy. McKerron estimates their frequency as 1 in 2500 pregnancies. In University College Hospital the frequency amongst booked cases from our own district was 1 in 1,100.

Varieties of Tumour Found In McKerron's series of 1,290 collected cases the tumour was cystic (simple or multilocular including papillomatous) in 68 per cent, and a dermoid in 25 per cent. Two per cent were solid and 5.2 per cent malignant. The more recent figures of Spencer correspond very closely. In his series of 55 cases personally examined the tumour was a cyst adenoma in 60 per cent, a dermoid in 27 per cent, a parovarian cyst in 10 per cent, and in 5 per cent a solid ovarian fibroid. In 8 cases the tumour was bilateral, three of these being dermoids. Caverley has recently reported a series of 83 cases 48.5 per cent of which were dermoids. The relative frequency of dermoids is due to the fact that they are small and usually lie in the pelvis, often giving rise to no symptoms until their presence is revealed by a routine pelvic examination during pregnancy, or by their causing obstruction in labour.

Site The tumour is situated in the true pelvis or above the pelvic brim with about equal frequency. Of Caverley's series of 87 cysts 52 per cent were in the true pelvis and 48 per cent above the pelvic brim. Two were in the pelvis to begin with but rose spontaneously above the pelvic brim, one before and one during labour.

Influence of the Cyst on Pregnancy and Labour There is an increased tendency to premature interruption of the pregnancy. This is shown in many statistics. Nystrom reported 111 cases treated expectantly with an abortion or premature labour rate of 25 per cent and Patton in 95 cases treated expectantly reported an abortion rate of 18.9 per cent. Abortion is due to complications in the cyst, e.g., torsion of the pedicle, incarceration of the tumour in the pelvis, etc. If situated in the pelvis the tumour is likely to obstruct labour very seriously, while if there is a large cyst above the brim it may cause obliquity of the uterus and so prevent the entry of the head into the pelvis.

Complications By far the most frequent complication is *torsion of the pedicle*, to which there is an increased liability in pregnancy, especially if the cyst lies above the pelvic brim. In the puerperium the liability is even greater because of the laxity of the abdominal walls, and the rapid involution of the uterus. McKerron reckoned that the frequency of torsion is 12 per cent in pregnancy, and 22.7 per cent in the puerperium, the liability to torsion apart from pregnancy being about 6 to 8 per cent. The symptoms of torsion are the same as when it occurs apart from

pregnancy—constant pain, vomiting, fever, abdominal distension, and sometimes shock and collapse. The tumour is usually tender and may enlarge suddenly from hæmorrhage into its walls or cavity.

Rupture of the tumour during pregnancy is rare apart from torsion and hæmorrhage. Most of the cases arise during labour from attempts to deliver the child past the obstructing tumour. Rupture in pregnancy is marked by sudden pain, change in shape of the tumour if multilocular, or complete disappearance if unilocular, and the appearance of free fluid in the abdomen. Spencer recorded a remarkable case in which a cyst containing 31 pints of fluid burst on the third day after an easy labour, the patient dying of syncope.

Hæmorrhage into the cyst is usually the result of torsion of the pedicle. Occasionally the blood so distends the cyst as to lead to rupture.

Adhesions between the cyst and surrounding structures are not uncommon. They were present in 20 per cent. of Caverley's cases, and are probably due to friction of the cyst setting up a localised peritonitis, but torsion of the pedicle and infection of the cyst may also cause them.

Suppuration is rare, except in the puerperium, when it results from injury and infection during labour. There is fever, pain from local peritonitis, and emaciation. Fortunately, the infecting organisms tend to die out after a short time so that the suppurating cyst can often be removed with perfect safety, and even though rupture occurs in the process it is not necessarily serious.

Rapid Growth in Pregnancy. There is no evidence that ovarian tumours grow more quickly during pregnancy than at other times. It is said that they sometimes increase rapidly in size in the puerperium, and this has been ascribed to the lessened intra-abdominal pressure, but most of the cases can probably be accounted for by torsion of the pedicle leading to hæmorrhage into the walls and cavity, or by suppuration following infection.

Symptoms of Ovarian Cysts in Pregnancy. Many give rise to no symptoms whatever, their presence being revealed only by routine examination. If, however, the cyst lies above the pelvic brim it may be large enough to cause discomfort, dyspnoea and palpitation from abdominal distension. If the tumour lies in the true pelvis, it may, if small, be symptomless, or if large enough to fill the pelvis it may, as the uterus grows, cause down bearing pain,

or may press on the bladder and cause frequency of micturition, or on the urethra and cause retention or on the pelvic veins and cause œdema of the lower extremities. Dermoids are least likely of all to cause symptoms probably because they grow so slowly and seldom attain a large size. The signs of torsion and rupture have been already described. Malignant tumours may cause pain and cachexia and there is usually free fluid in the abdomen.

Diagnosis. It must be determined first whether the patient is pregnant, and secondly if pregnant whether there is an ovarian tumour. While ovarian cysts are sometimes associated with secretion in the breasts it is always watery and scanty and there is no nipple pigmentation. Neither do ovarian cysts cause amenorrhœa except in the very rare cases in which they are bilateral and have destroyed both ovaries. In doubtful cases recourse may be had to the Zondek Aschheim test, and after the 16th week to X rays. Many of the smaller tumours are only discovered on routine examination of the pelvis which in early pregnancy should never be omitted. If there is a large cyst above the pelvic brim the abdomen may be larger than it should be for the period of amenorrhœa and the same may happen if a tumour occupies the pelvis and pushes the uterus upwards. The symmetrical shape of the abdomen found in normal pregnancy is changed, and there may be a groove separating uterus and tumour. By palpation we can often recognise two separate swellings though sometimes the uterus lies behind the tumour which has become fixed by adhesions to the anterior abdominal wall. If the cyst has a long pedicle it may be found in almost any part of the abdomen such as the hypochondrium or even in the loin.

A cyst lying wholly in the pelvis may be found on bimanual examination to be quite small and movable or so large as to fill the pelvis. It tends to displace the cervix upwards forwards or laterally and an abnormal position of the cervix should always arouse suspicion of some complication. An ovarian cyst can be moved apart from the uterus and is elastic in consistence but it may be so tense as to give the impression of a solid tumour. By rectal examination which should always be carried out it is usually possible to reach to a higher level in the pelvis and thus to explore it more thoroughly. Needless to say before examining a patient in whom an ovarian cyst is suspected, the bladder and rectum should be emptied.

Differential Diagnosis is necessary from uterine fibroids retro-

verted gravid uterus (p 291), hydronephrosis, ascites and hydramnios

Treatment If a woman who is not pregnant has an ovarian cyst it should always be removed as soon as possible because most of the cysts grow rapidly and all are liable to complications, and because, unlike fibroids, they do not atrophy after the menopause. In pregnancy, however, the decision is less simple, because ovariectomy is liable to cause abortion or premature labour, and in the later months of pregnancy access to the cyst may be difficult to obtain without turning the uterus out of the abdomen an undesirable process as it involves a very long incision in the abdominal wall. Besides should labour come on within a few days the wound is subjected to injurious strain. On the other hand we have seen that there is a great liability in pregnancy, if the cyst is left, and even more so in the puerperium, to serious complications such as torsion of the pedicle.

What is the risk of the occurrence of premature interruption of the pregnancy after ovariectomy carried out in the absence of complications? When surgical technique was less highly developed than it is at the present time, the risk of abortion was so great that it led many surgeons to rule out ovariectomy during pregnancy altogether, unless some complication arose. Fehling because his post operative abortion rate was as high as 23·4 per cent, as recently as 1900 stated that all ovarian tumours in pregnancy should be treated expectantly. Caverley in 1931, however reported an abortion rate of 11·4 per cent and this may be taken as representing the risk with modern technique, when the operation is undertaken as a prophylactic measure, without waiting for complications to arise. It is generally agreed that the risk is somewhat higher in the later than in the earlier months, probably from the greater amount of manipulation of the uterus rendered almost inevitable because of the difficulty in gaining access to the tumour.

What on the other hand is the risk of abortion if expectant treatment is adopted? In Caverley's series twenty six cases were treated expectantly and of these eight aborted or went into premature labour (30 per cent), while Patton and Nystrom reported abortion rates of 18·9 and 25 per cent respectively. Interruption of the pregnancy in these expectantly treated cases is due almost entirely to complications arising in the tumour, such as torsion incarceration suppuration etc, conditions involving

also a certain maternal mortality, which should be entirely absent if the operation is carried out prior to the onset of complications

On the evidence available, therefore, we may conclude that *the risk of premature interruption of pregnancy is at least as great with the expectant method as if ovariectomy is carried out*, and the patient is still left with a tumour that must be dealt with in labour or in the puerperium. The operation has only been postponed and it may become urgently necessary at any time on account of the onset of complications the presence of which may add considerably to its risk. *As a general rule, therefore ovariectomy should be carried out as soon as the tumour is discovered*. It is necessary, however, to make one or two exceptions to this rule. They are as follows

(1) Uncomplicated bilateral tumours when the patient has not the desired number of children. Should abortion occur there would be no chance of another pregnancy. Cæsarean section should be carried out at term or at any time after the end of the 36th week, and the tumours removed at the same time, or if the tumours are not likely to obstruct labour or can be pushed out of the pelvis labour might be allowed to take place at term by the natural passages, and the cyst removed early in the puerperium. Cæsarean section should not be done merely in order that the tumours may be removed at the same time. The same remarks apply to the patient who has previously had one ovary removed.

(2) In the second half of pregnancy, a small tumour lying above the pelvic brim and therefore not likely to obstruct labour, should be left unless and until complications arise. Labour should be allowed to take place at term and the tumour should be removed as early in the puerperium as possible—preferably on the first or second day.

(3) In the second half of pregnancy a tumour in the pelvis may be left provided it causes no symptoms. An effort should be made, however, to push it up above the pelvic brim. This is much facilitated by placing the patient in the Trendelenburg position, and under general anæsthesia the rectum and bladder having been previously emptied. If successful treat as described under (2). If unsuccessful, Cæsarean section should be performed at term, followed by ovariectomy. If it is decided to treat a patient expectantly she must be watched carefully, and early operation carried out should a serious complication arise.

Ovariectomy during pregnancy differs but little from the

operation as carried out at other times. The uterus should be handled as little as possible lest contractions start and if exposed during the operation should be kept covered with a pack wrung out of hot saline. Special care should be taken in ligaturing the pedicle, as should labour come on the ligature is liable to slip. Sedatives, of which morphia is by far the best, should be administered for three or four days following the operation and as an additional safeguard progesterone may be given—2 mgms daily.

Management during Labour. If a tumour is first discovered after labour has begun the treatment should be as follows.

(1) *Tumour above the Pelvic Brim and causing no obstruction.* Allow labour to take place by the natural passages, and remove the tumour as early in the puerperium as possible—preferably within the first week.

(2) *Tumour in the Pelvis.* Try to push it up with the help of the Trendelenburg position and general anaesthesia. It may be necessary to push the presenting part out of the pelvis before this can be done. If this succeeds treat as (1). If it fails, and provided the patient is not seriously infected, Caesarean section should be done, preferably through the lower segment, followed by ovariectomy. If the patient is seriously infected so as to render Caesarean section too risky, the abdomen may be opened at the end of the first stage of labour, and the uterus turned out of the abdomen if that is necessary in order to reach the tumour, which is then removed. An assistant now delivers the child by forceps after which the uterus is returned to the abdomen, and the wound in the abdominal wall closed.

Should the circumstances for example the patient's surroundings, be such as to render an abdominal operation undesirable the simplest plan may be to puncture or incise the cyst, and so evacuate its contents through the vagina and then deliver the child by forceps, or if the condition of mother and child after evacuation of the cyst is such that there is no need for hurry, spontaneous delivery may be allowed to take place. The tumour should always be removed as early as possible in the puerperium, preferably within twenty four hours. If left longer, the bruised cyst wall is almost certain to become infected, and in any case adhesions readily form after evacuation between the cyst and surrounding structures, which may render its removal at a later period both difficult and dangerous. A better plan than simple incision and drainage is to incise the vaginal membrane

over the cyst, enlarge the opening sufficiently, and then deliver the tumour intact into the vagina. The pedicle is clamped with a pair of long artery forceps, and the tumour removed, after which the pedicle is transfixed and firmly ligatured, and then replaced in the abdominal cavity. After delivery of the child the wound in the vagina is closed by a few sutures. This operation may be easy or extremely difficult, and the practitioner will be wise not to attempt it unless he has had some experience in vaginal surgery, and is prepared to open the abdomen if necessary, as the pedicle may slip back into the abdomen before the ligature has been applied, or a ligature that has been insecurely applied may slip and lead to fatal bleeding. *In no case should delivery past an obstructing tumour be attempted by version, or forceps even after craniotomy.*

In the Puerperium An ovarian tumour discovered in the puerperium should be removed without delay.

Cancer of the Cervix

This is, fortunately, a rare complication of pregnancy. Putting together statistics from various clinics, Sarwey concludes that its frequency is 1 in 2 000. In University College Hospital there were only 2 cases of cancer and 1 case of sarcoma of the cervix in 12,000 booked cases—an incidence of 1 in 4,000.

The rarity of its occurrence in pregnancy is due chiefly to two causes. First, while cancer of the cervix is most often met with in the age period forty to fifty, pregnancy is comparatively rare after forty. Secondly, cancer of the cervix tends to prevent conception. Stratz found that of 1,034 patients with this disease only 12 became pregnant.

Age Incidence While the highest incidence of cancer of the cervix falls in the age period forty to fifty, that of cancer of the cervix in pregnancy is thirty to forty. Spencer states that below thirty the frequency of cancer of the cervix in the pregnant is six times as great as in the non pregnant. Of his series of 10 cases the youngest was twenty six and the oldest forty.

Effect of the Cancer on Pregnancy and Labour. According to Sarwey, 30 to 40 per cent. of the pregnancies complicated by cancer of the cervix end either in abortion or premature labour. Only two of Spencer's 10 cases went to term. If the cancer is early and causes no constitutional disturbance, the pregnancy usually goes to term, but if the cervix is considerably infiltrated

and especially if the disease has invaded the parametrium or the lower segment of the uterus, or if the case is complicated by local or general sepsis, severe hæmorrhage, or constitutional disturbances and pyrexia, the pregnancy is apt to be prematurely interrupted

The effect on labour varies also with the extent to which the cervix is involved. If part of its circumference is free from growth dilatation may proceed normally, and labour may even be rapid and easy. If, on the other hand, the entire cervix is infiltrated, dilatation may take place extremely slowly. Usually, too, the membranes rupture early, and this increases the danger to mother and child. Occasionally the cervix may be so hard that dilatation of any degree is impossible. The rigid cervix then presents an insuperable obstruction, and if labour pains continue the *uterus may rupture*, or the obstruction may be relieved by *rupture of the cervix*, generally with severe hæmorrhage. *Avulsion of the entire cervix* may even take place in front of the advancing head. Still another ending has been recognised, namely "*missed labour*." The uterine contractions come to a complete standstill, the cervix remaining undilated. The fœtus in such cases usually dies *in utero*, and being retained may undergo putrefaction, especially if the membranes are already ruptured. Sarwey attributes this cessation of contraction to infiltration of the uterine muscle by cancer cells.

If the cervical growth is sloughing it is usually heavily infected by virulent streptococci. Infection of the placental site is then liable to occur after delivery. Septic thrombo phlebitis of the pelvic veins is in such cases a common cause of death.

Effect of the Pregnancy on the Cancer. It is usually stated that the increased vascularity of the pelvic organs in pregnancy leads to rapid progression and dissemination of the growth, especially if the cancer is of the soft "medullary" type. Zweifel in one case placed a thread at the outer edge of the growth, and found that in fourteen days the growth had extended two finger breadths beyond it. Spencer, on the other hand, thinks that pregnancy has little influence on the cancer. In one of his cases that he was able to observe carefully the cancer did not apparently increase in size in two months. It must be remembered that most of the patients are comparatively young, and that in young patients cancer always tends to grow rapidly.

Symptoms. The symptoms do not differ from those of cancer

of the cervix apart from pregnancy. There is no early sign of cancer of the cervix and when signs appear such as bleeding discharge etc. the disease is always advanced. The first sign is usually bleeding. It may first occur on coitus and may be only present then or it may occur apart from trauma at irregular and infrequent intervals the patient being free from any symptoms between. Sometimes the earliest sign is an abundant thin and watery discharge which may not attract attention or there may be a more or less constant blood stained discharge. The bleedings may be mistaken for menstrual periods, so that the pregnancy may be overlooked. Pain is a late symptom and is seldom present except in advanced cases, in which the disease has extended beyond the cervix into the surrounding tissues. It is aching and gnawing in character worse at night, and usually radiates from the sacral region into the thighs. When the growth becomes necrotic the discharge has a characteristic foul smell. When it becomes septic there may be severe constitutional disturbances with fever rapid pulse and perhaps rigors. At any time ulceration may lead to severe bleeding.

Diagnosis This is easy in most cases. There is a history of *irregular bleeding which leads to a vaginal examination*. The cervix is large ulcerated friable, and *bleeds readily and freely on touching*. *Friability* is one of the most distinctive characters of the growth and can best be tested by means of a probe. Sometimes however, the appearances are not at all characteristic. Thus there may be a hard smooth enlargement of the cervix, with no ulceration and no bleeding or history of it. Spencer records a case in which 'nearly every day for a month the cervix was swabbed with 1 in 3 000 perchloride of mercury solution' without the slightest bleeding.

The chief conditions for which early cancer is liable to be mistaken are *cervicitis*, *tubercle* and *syphilis*. The last two are rare and usually require microscopical examination to distinguish them with certainty. In syphilis the Wassermann reaction is positive. Cervicitis can usually be recognised clinically by the probe test, as the cervix in this condition is not friable and bleeds only very slightly or not at all when the probe is pressed firmly against it. If there is still doubt a piece should be removed for microscopical examination.

Treatment (1) *Early Cases in Early Pregnancy* Either radical abdominal hysterectomy (Wertheim's operation) or treat

ment by radium and λ rays, should be carried out at once. If the latter method is adopted the pregnancy should first be terminated. Radium may then be inserted in the second or third week of the puerperium, but if there are any signs of puerperal sepsis the insertion must be postponed till this has cleared up. It is always inadvisable to allow pregnancy to continue after the application of radium to the cervix, as the child is likely to be microcephalic, or in other ways defective.

Spencer has had excellent results from high amputation of the cervix with the Paquelin cautery after delivery. In two cases in which he performed this operation fourteen and eighteen days after delivery the patient was alive and well respectively twenty five and twenty two years later.

(2) *Early Cases in Late Pregnancy* Caesarean section should be done, followed by radical abdominal hysterectomy, or if preferred, conservative Caesarean section may be followed by the use of radium and λ rays. At this period the child can therefore generally be saved, and this is practically always the case if the pregnancy has reached the 34th week. If it has not quite reached that period it may be justifiable to wait two or three weeks in order to give the child a better chance of survival.

In all these cases "operability" will be determined by the extent of the disease. Generally speaking, if the uterus is much fixed and if the growth has extended clinically beyond the confines of the cervix, viz., into the vagina, especially its anterior wall, bladder, utero-sacral ligaments or parametrium, the case is inoperable, as it is usually impossible to remove the growth with a margin of healthy tissue—the only procedure that renders operation justifiable. Such cases should be treated by radium and λ rays. If, on the other hand, the growth is confined to the cervix and the uterus is freely movable the case is usually operable and can be treated by means of the Wertheim operation (radical abdominal hysterectomy). Even for such 'operable' cases, however, radium followed by deep λ ray therapy is now preferred by most surgeons, for it gives as high a cure rate and there is almost no primary mortality, whereas the "primary mortality" (i.e., the percentage of the patients operated on who die during or soon after, and as a result of the operation) of radical abdominal hysterectomy is extremely high (16 to 20 per cent.)

(3) *Advanced Cases in Early or Late Pregnancy* If the growth is septic and sloughing it may be unsafe to attempt induction

of abortion or of labour, and in any case the cervix will probably not dilate. The best treatment is then Cæsarean section or abdominal hysterotomy, according to the stage of the pregnancy, followed by subtotal hysterectomy. In that way the easily infected placental site is removed. After recovery from the operation, radium should be applied in the cervical canal combined with suitable applicators in the vagina, and the whole followed by a course of deep X-rays. It is an important practical point to observe, that if the uterus has been amputated at the level of the internal os the cervical canal may be too short to permit the insertion of a radium applicator. *The amputation should therefore be carried out some distance above that level.* In deciding the exact level allowance should be made for subsequent involution. The object of the hysterectomy is to remove the placental site, and it is sufficient if the uterus is amputated just below it.

Should the pregnancy be in its early stages, it is usually advisable to carry out these procedures without delay. If, however, the fœtus is near viability it is desirable to wait until the end of the 36th week in order to give the child a good chance of survival.

REFERENCES

- CAVERLEY, C. E. *Am Jour Obst and Gyn*, 1931, 21, 566
 FEHLING *Cent f Gynäk*, 1900, 24, 1044
 LANDAU, T. *Myom bei Schwangerschaft, Geburt und Wochenbett.* Berlin 1910
 MCKERRON, R. G. "Pregnancy, Labour and Childbed with Ovarian Tumour" 1903
 MARSHALL, G. B. *Jour Obst and Gyn Brit Emp*, 1910 17, 81
 NYSTROEM *Zent f Gyn*, 1909, 33, 1534
 OLSHAUSEN, R. *Leit s Handbuch der Gynäkologie*, 1897, Bd II, 76"
 PATTON, C. L. *S G O*, 1906, 3, 413
 PIERSON, R. W. *Am Jour Obst and Gyn*, 1927, 14, 333
 PINARD, A. *Annales de gyn*, 1901, 56 165
 SARWEY *Leit s Handbuch der Gynäk*, Bd III, II Hälfte Erste Abteilung
 SPENCER, H. R. "Tumours complicating Pregnancy, Labour and the Puerperium" London, 1920
 WATSON, B. P. *Am. Jour Obst and Gyn.*, 1932, 23, 351
 ZWEIFEL Quoted by H. R. Spencer "Tumours complicating Pregnancy, Labour and the Puerperium" London, 1920

CHAPTER XXXIV

VENEREAL DISEASES IN PREGNANCY

Few complications of pregnancy give rise to greater difficulty in diagnosis and treatment than do the venereal diseases. Especially is this true in regard to syphilis, in the diagnosis and treatment of which many important advances have been made in recent years.

Syphilis

The routine Wassermann test carried out in the antenatal clinic of the Edinburgh Royal Maternity Hospital on 2,000 consecutive women was positive in 180 (6.5 per cent). Gammeltoft found it positive in 148 of 2,200 pregnant women in Copenhagen (6.7 per cent) and Webster reports that of 1,867 specimens of blood taken between June, 1925 and the end of 1927 from women attending the Cardiff Antenatal Clinics, 3.1 per cent were positive.

Diagnosis of Syphilis in Pregnancy. Attention should be directed to the following points:—

(1) *The Clinical History.* In about 70 per cent of syphilitic primigravidae a history of clinical evidence of syphilis will be obtained. In syphilitic multiparæ such information is only obtainable in about 30 per cent. There is a good deal of evidence to show that the reason for this absence of a history of syphilis in multiparæ is not that signs of syphilis have never been present but that they have been forgotten or are denied. I have discussed this fully elsewhere, but have since then met with a striking example in illustration. A 1 para was sent from the venereal diseases clinic of the Edinburgh Royal Infirmary with a letter which stated that her previous pregnancy two years before had ended in a miscarriage, and that just before the miscarriage she had come under observation, suffering from the usual signs of secondary syphilis—namely, rash, sore throat, mucous patches, and condylomata, with a triple positive Wassermann reaction. On questioning her most carefully regarding her past history I found that she denied that any such signs had ever been present.

(2) *Clinical Signs of Past Syphilis.* These may be found on careful examination in the form of scars of healed gummata, especially about the calves and knees, leucoderma, etc.

(3) *Obstetric History.* A history of repeated still births, abor-

tions or neonatal deaths without obvious cause to account for them such as nephritis or birth injury should arouse suspicion. There are often however occasional strange and unexplained lucid intervals in the obstetrical history. Thus there may be one or two apparently healthy children sandwiched in between two syphilitic miscarriages or between two syphilitic children. Abortion in early pregnancy i.e. before the fifth month, is not usually due to syphilis but after this time it often is.

(4) *The Wassermann Reaction* A strongly positive Wassermann reaction is in my opinion certain evidence of syphilis. I do not believe that the toxæmias of pregnancy can give rise to it at least I have never seen an example of that. On the other hand a patient may have a negative reaction and yet be syphilitic and give birth to syphilitic children. It is important that the practitioner should recognise this. It is only fair to state in this connection that I have never met with a case in which a mother with a negative Wassermann test gave birth to a foetus the organs of which contained spirochaetes. Such a case has however, been recorded by Eardley Holland.

(5) *Examination of the Product of Conception* This is perhaps the most valuable method of diagnosis at our disposal. Signs of syphilis in the product of conception are certain evidence of syphilis in the mother, as the mother of a syphilitic child is always herself syphilitic although the opposite does not hold, and a syphilitic mother especially one with old syphilis may give birth to a healthy child. Evidence may be found in (a) the placenta (b) the cord (c) the foetus.

The Placenta The classical characters of the syphilitic placenta are well known its pale greasy bulky appearance is described in every midwifery textbook. What is less well known is that these typical appearances are only found in the placenta of the macerated foetus and that if the foetus is born alive though syphilitic the placenta may seem perfectly healthy both to the naked eye and on microscopic examination. This is because the immediate cause of intra uterine death of the foetus in syphilis is obliteration of the foetal capillaries in the villi. This obliteration is brought about by subacute inflammation the end result of which is fibrosis causing enlargement of the individual villi (Fig 58). If the fibrosis is extensive the foetus dies and is born macerated if the fibrosis is less marked the foetus is born alive and the placenta shows little or no change from normal.

The normal placenta at or near term weighs about one sixth and never more than one fourth of the foetal body weight. If a placenta at term, or in the ninth month weighs one fourth or more of the body weight it is almost certainly syphilitic. *A placenta however, with a normal weight ratio does not necessarily exclude syphilis.* That is because a healthy placenta at term may weigh as little as one tenth or even one fifteenth of the foetal body weight. Even

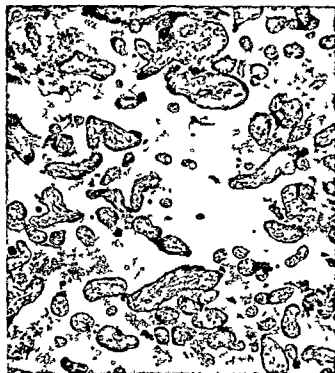


FIG. 57. Normal placenta. The villi are slender and vascular and the intervillous space wide.

if such a small placenta were affected by syphilis the consequent enlargement might not be sufficient to raise its weight above or even to the normal limit.

Although the microscopic examination of the syphilitic placenta usually reveals nothing absolutely diagnostic, yet the appearances are generally highly suggestive—namely, the enlarged cellular non vascular villi with the correspondingly diminished intervillous space.

In passing it may be noted that spirochaetes are practically never found in the syphilitic placenta. The reason for this is not known.

The Cord. Most valuable evidence may be obtained from the cord. The piece of cord for examination must be taken as close to the foetal end as possible. The usual change is round-cell infiltration around, and in the walls of, the umbilical vein. The



FIG. 58. Syphilitic placenta. The villi are thick and non-vascular, and the intervillous space diminished.

spirochaete may be demonstrated in the tunica intima by appropriate staining methods (Fig. 59). This diagnosis of syphilis from the cord is particularly valuable, as the cord is available when the foetus is born alive and apparently healthy. It must, however, be emphasised that even when syphilis is present the cord may appear quite normal.

The Foetus. If the foetus is macerated this is in itself suspicious, as about one-third of all macerated foetuses are syphilitic.

In the examination of the macerated foetus four points will be of assistance (a) the liver, (b) the spleen, (c) the epiphyses, (d) the presence of the spirochæte in the organs

The Liver The normal foetal liver weighs about one twentieth to one thirtieth of the body weight. If it weighs one twelfth or over it is almost certainly syphilitic. At the same time, it should be remembered that as in the case of the placenta and chiefly



FIG. 59 Section of umbilical cord of syphilitic foetus. Spirochætes are present in the tunica intima.

for the same reason it may be less than one twelfth e.g. one twentieth or one twenty fifth and yet the foetus be syphilitic.

The Spleen A normal foetal spleen may weigh as much as $\frac{1}{100}$ of the body weight. If it weighs more than this it is almost certainly syphilitic. Again as in the case of the liver and placenta, its weight ratio may be normal and yet the spleen be syphilitic. Such exceptions, however, are rarer than in the case of the liver and placenta. An enlarged spleen is a most valuable sign of foetal syphilis.

Chondro Epiphysitis The jagged, irregular chondro-epiphysal junction is well known and requires no further description. In cases of doubt it may be demonstrated microscopically.

Presence of Spirochaetes These are as a rule best demonstrated in the liver, spleen suprarenal gland and kidney either by dark ground examination or by the Levaditi method of silver staining for permanent specimens. Their presence is of course absolute evidence of syphilis.

The Fresh Dead Fetus or the Dead Infant If the foetus is expelled dead but in a fresh condition or if the child dies in the neonatal period its organs are available for microscopic examination. The changes are usually most marked in the liver and lungs but the thyroid pancreas and pituitary may also show characteristic changes. Generally speaking they are all of the same nature namely a subacute inflammatory change with formation of new fibrous tissue which compresses and partially destroys the parenchyma. There is only space here to describe them as they appear in the liver lung and pancreas.

Liver Microscopically the following changes are met with (a) *Periportal cirrhosis*—the commonest change. The periportal tract contains young connective tissue and plasma cells. (b) *Inter cellular cirrhosis* (Fig 60). The liver cells are separated from each other by a very fine connective tissue which arises from the basement membrane lining the sinusoids. (c) *Biliary gummata*—the rarest form. The gummata are visible to the naked eye as minute greyish spots dotted thickly over the cut surface. Microscopically they consist of fixed connective tissue cells and endothelial cells. In later stages the centres of the gummata may be occupied by a caseous looking material due to waxy change in the fixed connective tissue cells. These gummata may be the only abnormality present or they may be combined with fine cirrhosis. Spirochaetes are present not in the gummata but in the more normal liver tissue surrounding them.

Lungs There is increase of the interstitial tissue in the alveolar walls so that the walls are thickened and the alveolar spaces diminished in size. The endothelial cells lining the alveoli are shed into the lumen which they loosely fill (pneumonia alba). Microscopic gummata may also be present.

Pancreas This organ is one of those most often affected and shows fibrosis with compression and destruction of acini and of the islands of Langerhans.

The Cord Blood in Diagnosis The Wassermann reaction on the cord blood of the infant provides valuable though not conclusive evidence of the presence or absence of syphilis. McKelvey and

Turner, from a study of 943 cases, found that among infants in whom the cord blood was positive 81.4 per cent were ultimately shown to be syphilitic, while of infants with negative cord blood born of a syphilitic mother 13.7 per cent were proved to have congenital syphilis. "It is evident that the test is not an infallible guide to the presence or absence of syphilis in the offspring, but it does provide important information regarding the ultimate diagnosis. A positive test alone is not an indication for immediate

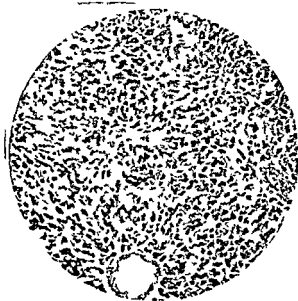


FIG. 60 Liver of syphilitic child Intercellular cirrhosis

treatment, but it points strongly to the necessity for further intensive study of the infant."

X-ray Changes in the Bones The presence of the characteristic changes in the epiphyses of the long bones (chondro epiphysitis) in the first month or so after birth is diagnostic of syphilis, but the absence of such changes does not exclude syphilis.

Congenital Syphilis in Pregnancy The diagnosis of the syphilitic taint may in these cases present great difficulty. There may be a history of repeated dead births without obvious cause, or a series of infants may have been born prematurely and survived but a short time. The Wassermann reaction of the affected parent may be, and indeed usually is, negative. Spirochetes are not usually

found in the foetal organs but a careful examination should be made for evidence of the histological changes described above. A careful enquiry into the family history may yield most significant data. For example the grandmother on either side may have given birth to dead born infants or there may be a history of repeated dead births or early infantile deaths in the families of the patient's or her husband's brothers and sisters. In the patient herself there may be evident stigmata of congenital syphilis. Finally if all these investigations fail to yield a conclusive result and congenital syphilis is still suspected the 'therapeutic test' may be applied to the patient and her husband by treating them with anti-syphilitic remedies before pregnancy. This treatment should be given to the mother also throughout the succeeding pregnancy.

Treatment In treatment four main principles should be borne in mind.

(a) It should commence as early in pregnancy as possible or better still a full curative course of treatment should be completed before pregnancy is allowed.

(b) The patient should be treated by arsenical compounds in every pregnancy—no matter whether she seems cured or not.

(c) Treatment may be continued with safety up till the time of confinement.

(d) Arsenic and mercury or bismuth should not be combined in treatment on account of their tendency to damage the kidney. In this respect bismuth and mercury are more dangerous than arsenic. If there is no albuminuria however they may be given alternately. If there is albuminuria it may be necessary to stop all treatment except by potassium iodide so long as the albuminuria lasts. In some rare cases the albuminuria may be due to syphilis and then arsenical treatment carefully watched may be tried.

Method of Treatment The best results are obtained by the use of novarsenobenzol intravenously starting with a small dose of 0.3 or 0.45 gm. and increasing carefully to 0.6 or 0.75 gm. The injections should be given once weekly and continued until 6 or 8 doses have been given. A careful watch should be kept for albuminuria especially in the later months and great attention should be paid to the state of the teeth to prevent pyorrhœa. After this there should be a month's interval during which mercury in the form of grey oil is administered intramuscularly into the buttock once weekly the site of the injection being massaged to

aid absorption. Each dose is 10 minims, which corresponds to 1 grain of metallic mercury. Intramuscular bismuth, preferably one of the insoluble compounds such as biereol, or, as recommended by Lees, an insoluble salt in a very fine suspension in isotonic glucose solution, may be given as an alternative twice weekly. Bismuth is at least as efficacious as mercury, and is superior in that its injection is less painful and less liable to damage the kidneys.

In the treatment of syphilis strict attention should be paid to dental hygiene. Dental lesions should be attended to promptly and patients receiving bismuth or mercury should, apart from regular brushing of the teeth and gums with a good dentifrice, use

Treatment of Mother	No. of Cases	Syphilitic Infants	Healthy Infants	Percentage	
				Syphilitic	Healthy
Syphilis not treated	201	194	7	96.5	3.5
Mercury before pregnancy	87	78	9	90.0	10.0
No treatment during pregnancy					
Salvarsan before pregnancy	15	12	3	80.0	20.0
No treatment during pregnancy					
Mercury during pregnancy	111	80	31	72.0	28.0
Salvarsan before pregnancy	26	7	19	27.0	73.0
Mercury during pregnancy					
Salvarsan during pregnancy	98	19	79	20.0	80.0
Salvarsan before pregnancy					
Salvarsan during pregnancy	7	1	6	17.0	83.0

a mouth wash containing common salt, one teaspoonful to a tumbler of cold water, the mouth being rinsed out for an hour three or four times daily.

These courses of arsenic and mercury or bismuth should be given alternately until the end of pregnancy. After delivery treatment should be continued, a course of treatment of eighteen months' duration, as outlined above, is the minimum, and it is advisable to continue treatment for a year after all tests are negative. In the case of husbands with old and probably cured syphilis, it is well to advise a prophylactic course as a safety measure for some weeks preceding marriage.

What is the outlook for obtaining a healthy child by such measures?

The most complete results so far reported are those of Gammeltoft, who has followed up some of the children for as

long as fifteen years. The table on p. 529 gives the main facts. The best results in this series therefore were obtained from salvarsan both before and during pregnancy, but even with that no guarantee could be given that the child would not be a congenital syphilitic. It is probable that better results can be obtained by the combined treatment by arsenic and mercury or bismuth as described above.

Gonorrhœa

Gonorrhœa in pregnancy does not often give rise to acute symptoms such as cystitis. If it does, the diagnosis is fairly obvious and treatment in the acute stages is almost standardised—namely rest in bed, prevention of spread of infection by vulval protection, hot antiseptic sitz baths, carbohydrate diet, and plenty of fluid, M & B 693 (p. 533) and, as soon as the patient can bear it, treatment by local applications in the lithotomy position. Arthritis is in our experience, the most common complication and its treatment often demands much circumspection.

We shall deal here with the more common subacute or chronic infection, its methods of diagnosis and treatment.

Anatomical Considerations. Some anatomical peculiarities of the female genital tract explain why primary infection is limited to certain areas. The vulva and vagina are covered by squamous epithelium, which in the adult female is very resistant to the entrance of the gonococcus. But there are about the vulva certain vulnerable areas which are not so protected, and through which the gonococcus can enter and set up infection. These are (1) the duct and gland of Bartholin, (2) the urethra and periurethral glands, especially Skene's glands. Therefore, while we do not find a primary vulvitis in the adult, we often get a Bartholinitis and a urethritis. The cervix is a third vulnerable area in the lower genital tract. Its canal is lined by columnar epithelium between the cells of which the gonococcus can easily penetrate into the deeper cervical tissues. Into the canal open the racemose glands of the cervix, and these also the gonococcus can easily enter, and lie safely entrenched beyond the reach of local applications. The cervical infection sets up cervicitis—the well known cervical “erosion” or catarrh, with discharge of muco purulent secretion, this, pouring over the vagina and vulva, may set up a secondary vaginitis or vulvitis, and both vagina and vulva become inflamed and swollen.

Diagnosis Examination can only be properly carried out with the patient in the lithotomy position, and in a good light. In private practice this position can easily be obtained by a pair of lithotomy straps. The gland of Bartholin is first examined by picking up the labium majus at the junction of its posterior and middle thirds, between the finger and thumb. Normally the gland is not palpable. If any enlargement is felt it is almost invariably due to gonorrhœa. It may, if only slight enlargement and induration are present, be due to a very old standing gonococcal infection.

Next, the orifice of the duct of Bartholin should be examined, this is a pin point opening at the junction of the hymen with the labium minus, near the posterior end of the latter. An area of rosy redness spreading on to the adjacent mucosa is suspicious but it is not such strong evidence as enlargement of the gland. It may be possible to squeeze a little pus from the duct, if so, it should be spread on a glass slide and allowed to dry in air, being afterwards sent to a bacteriologist for examination for gonococci.

The urethra should next be examined, care being taken that the patient has not passed urine for three hours. The urethra should be cleansed by pledgets of dry sterile cotton wool and then milked from the neck of the bladder downwards to the external meatus, if pus is obtained, a smear, and possibly a culture, should be taken. The absence of Bartholinitis and urethritis by no means excludes gonorrhœa.

The cervix should then be examined, preferably using a bivalve speculum, which gives the best exposure. In acute infection it usually appears purple and congested, and bleeds on touching. In more chronic cases there may be actual desquamation of epithelium, the well known erosion. Often it is bathed in mucopurulent secretion. The cervix is first of all carefully cleansed with an alkaline solution such as sodium bicarbonate, 1 dram to 1 pint, and then a swab is taken from the canal care being taken not to trespass above the internal os. Smear or culture is again made. The cervix, however, may look perfectly normal, and yet gonococci may be obtained from the canal. A swab merely from the vagina is generally of no value whatever in excluding gonorrhœa.

What is the value of a negative smear? A negative smear is of little value in diagnosis and it should be repeated on at least three successive occasions. The gonococcus is most likely to be found

just after a menstrual period but this test is not available in pregnancy We may, however give a provocative vaccine injection of 200 million gonococci and examine the discharge twenty four forty eight and seventy two hours later If in doubt regarding the diagnosis it is always better to treat the case as if it were gonorrhoeal

Treatment The multiplicity of local applications for gonorrhoea is evidence that none is very efficient Almost the weakest antiseptic will kill the gonococcus if it can be brought into contact with it but the organisms lie entrenched and beyond reach in the periurethral or cervical glands

The patient should be in the same position as for diagnosis and the external genitals cleansed with a solution of lysol or perchloride of mercury With a bivalve speculum the cervix is exposed and from it and the vagina all mucus is wiped either with a dry sterile swab or with sodium bicarbonate solution The latter removes mucus better and leaves a clean surface The portio and vagina should now be swabbed with a silver or other preparation such as 10 per cent protargol or neoprontosil or 1 per cent picric acid in spirit After trying many of these remedies we think equally good results are obtained by swabbing with saline solution In pregnancy the parts must be handled very carefully and special care be taken in making applications to the cervical canal lest premature labour be induced One may however, very gently swab the canal using a Playfair's probe dressed with cotton wool dipped in the selected solution, and rotating the probe carefully It is rare to find urethritis persisting at this stage but if it does it may be necessary to inject with a glass syringe carrying an acorn nozzle a silver or other preparation such as 1 in 1 000 acriflavine or 1 per cent silver protein or as an alternative medicated urethral bougies may be used containing 10 per cent neoprontosil or any similar preparation Sometimes there is a chronic infection of Skene's ducts and it is advisable to inject them by means of a blunt pointed hypodermic needle or they may be destroyed by a cautery Finally the cervix and vagina are dusted with an astringent dusting powder such as dermatol (subgallate of bismuth) which helps to keep the surface dry Twice a week is generally sufficient for local treatment and in most cases there is no need for rest in bed

Detoxicated vaccines are of considerable assistance in clearing up the discharge starting with a dose of 5 000 million repeating once

weekly, and gradually increasing to 50 000 million which may be continued till the end of pregnancy. Ionisation and diathermy are not applicable in pregnancy.

M & B 693 Good results have recently (McGregor Robertson) been reported from the use of sulphapyridine M & B 693 (May and Baker) in acute gonorrhœa and there is apparently no contra indication to its use in pregnancy. Batchelor recommends the following dosage: 1st to 4th day 4 grams daily; 5th to 8th day 3 grams daily; 9th to 14th day 2 grams daily preferably after food. The patient is warned to avoid salts and sulphur containing articles of food such as eggs and onions. Vaginal douching should be used at the same time and continued for a fortnight or three weeks after the tablets are stopped. This drug is apparently less toxic than sulphanilamide but 45 per cent of McGregor Robertson's patients complained of toxic effects—headache, nausea, giddiness, rash and rarely dyspnœa. Gonococci disappeared from smears in periods varying from one to six days but relapse occasionally occurred.

With the treatment outlined above it is almost always possible to get the discharge much improved in a few weeks and before delivery occurs. Very few of the cases cause trouble in the puerperium.

After delivery every care must be taken to prevent ophthalmia neonatorum. The prophylactic instillation of 1 per cent solution of nitrate of silver should never be neglected.

Finally it must be emphasised that the only absolute test of cure of gonorrhœa is the absence of the power to infect the male and that treatment must be continued after pregnancy is over until at least all clinical evidence of the disease is eradicated.

Arrangements for Diagnosis and Treatment The following principles may be laid down as the minimum necessary for the proper diagnosis and treatment of venereal disease in pregnancy.

(1) A routine Wassermann test should be carried out on every patient at the first visit to the antenatal clinic, treatment being started immediately a positive diagnosis of syphilis is made.

(2) The treatment centre should be in the maternity hospital, special days being set apart for that purpose. Pregnant women with venereal disease are generally innocent victims and resent attendance at an ordinary venereal disease department among patients of doubtful character.

(3) The treatment should be carried out by a woman expert who may or may not be a member of the maternity hospital staff.

It is probably preferable that she should be the person responsible for the treatment of women in the ordinary venereal disease clinic. She would then have charge of the mothers after delivery also, and until discharged cured.

(4) Antenatal beds should be provided in the maternity hospital for women suffering from venereal disease. These should not be labelled "V D beds" but simply "antenatal." Such beds are necessary for—

(a) Patients with acute gonorrhœa and those ill with complications such as arthritis.

(b) Patients living too far away to attend as out patients.

(c) Patients who, because of the advanced stage of pregnancy, cannot attend as out patients with sufficient regularity.

(d) Patients suffering from venereal disease together with some of the ordinary non venereal complications of pregnancy—for example *pre eclamptic toxæmia*—requiring indoor treatment.

(e) All cases suffering from severe vaginal discharge should be treated in the clinic, whether the gonococcus has been found or not. If only cases of proved gonorrhœa are treated the majority will be missed, and if the department is not labelled "V D" no stigma attaches to treatment there.

(6) Attached to every maternity hospital there should be a pathologist who is expert in the examination of the products of conception for evidence of syphilis. Unless this is done invaluable evidence—often the only evidence—will be missed.

(7) At the end of each month or oftener, a list of syphilitic infants or of suspected cases requiring observation, should be sent to the child welfare medical officer. He will, of course, keep in touch with the children, examine them at intervals, and have treatment carried out if necessary.

(8) The maternity hospital venereal disease clinic should be in close contact with the general venereal disease clinic of the hospital or town in which it is situated. After delivery it will generally be found best that treatment should be continued in the general clinic. This continuity of contact will be easy if the treatment in each is carried out by the same medical officer.

(9) Any complete scheme demands the appointment of a nurse who will follow up patients failing to attend regularly for treatment. It is unnecessary to tell patients that they are suffering from syphilis or gonorrhœa, but if they fail to attend regularly or refuse to undergo treatment it is often best to do so, and a quiet

talk with the patient, and perhaps with her husband, usually has a salutary effect.

(10) Co operation with the venereal disease centre will ensure getting in touch with the husband and treating him as well as the mother.

Trichomonas Vaginitis

Though not one of the venereal diseases this condition may be suitably included here. Investigations carried out within the last few years have shown that it is not uncommon in preg-

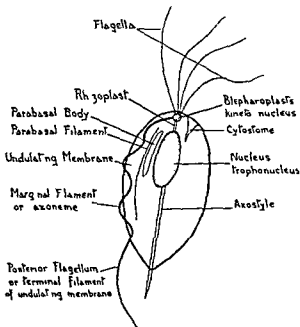


FIG 61 *Trichomonas vaginalis* (Glen Liston)

nancy. Bland, Wenrich, and Goldstein found the organism in 130 (22.7 per cent) of 600 pregnant women (white and coloured) examined, but only 18 (13.3 per cent) of the women in whom the organism was found complained of irritating symptoms, though all had an abnormal vaginal secretion. The *trichomonas vaginalis* is a flagellated organism, varying greatly in size and shape, but usually oval at the anterior end and pointed posteriorly, and possessing an undulating cell membrane surrounding its anterior two thirds (Fig 61). Three long whip like flagella which have a characteristic vibrating motion arise from the anterior end and a single one from the posterior extremity.

Clinical Features Typically there is an abundant thick vaginal discharge which is greenish yellow, offensive, and frothy, and gives rise to intense itching and burning in the external genitals and sometimes to dull pains in the right and left lower quadrants of the abdomen. The papillæ on the vaginal walls are often enlarged and may bleed readily on touching in which case the discharge may be bloodstained. The cervix is

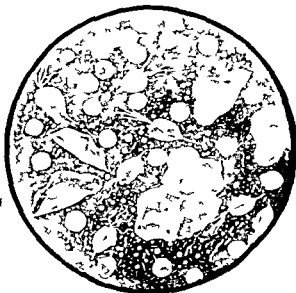


FIG 69. *Trichomonas vaginalis* shown in fresh moist vaginal smear with many leucocytes, few epithelial cells and numerous bacteria. This smear is typical of a case of chronic *Trichomonas vaginitis*. *T. vaginalis* is the only *Trichomonad* which has been proven to be present in vaginal smears in *Trichomonas vaginitis* and is morphologically distinct from *T. buccalis* and *T. hominis*.

usually healthy, and its canal may contain a normal mucous plug, but the portio may show areas of superficial redness. There is no tendency to infect the husband. Glen Liston found that 50 per cent of women suffering from gonorrhœa and attending a venereal disease clinic were also infected by trichomonas.

Diagnosis The offensive yellow and frothy discharge, together with the enlarged and sometimes bleeding vaginal papillæ and a healthy cervix, are characteristic. A drop of pus should be taken from the vagina not with a swab but with a platinum loop, placed on a warm glass slide, mixed with one drop of physiological

saline solution and examined at once for the organism, which is usually easily found in large numbers (Fig 62)

Treatment Goodall has had satisfactory results from treatment by vaginal cones containing 1 per cent picric acid, which are inserted daily and supplemented by daily douches of plain water, soap solution, or lactic acid, 1 dr to one quart of water With this treatment the discharge and symptoms clear up in from eight to ten days Douching by itself is useless for though the organism can be easily got rid of in this way it invariably returns when the douches are stopped

Adair and Hesseltine have recently claimed that an important predisposing cause of vaginitis of all kinds is deficiency of glycogen



FIG 63 Apparatus for insufflating the vagina with silver picrate ('picragol') powder (Messrs John Wyeth & Brothers)

in the vaginal epithelium, and that improved results in treatment can be obtained by introducing lactose or glucose into the vaginal canal This principle is observed in the recently introduced preparation Devegan (Bayer), or its British equivalent Stovarsol vaginal compound suppositories (May and Baker) Two of either of these should be inserted each night

One disadvantage about treatment by tablets alone is that they are difficult to place accurately in the upper vagina, and even if they are so placed it is not always possible for the material contained in them to penetrate between the vaginal rugæ This difficulty is overcome by the use of the insufflator (Fig 63) by means of which a powder is blown into the vagina while it is distended by air The instrument occludes the vaginal ostium and thus permits the distension by means of a hand bulb The powder used is 5 gr of a 1 per cent dispersion of silver picrate in kaolin which has a useful drying effect (Golub and Shelanski) The insufflation is used once weekly and in the intervals one

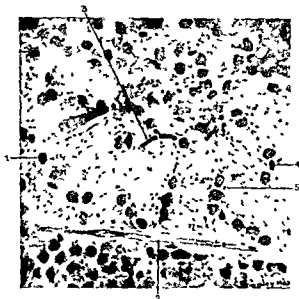


FIG. 84 Vaginal Thrush. (1) Pus cells (2) Septate pseudomycelial filament of thrush parasite *oidium albicans* (3) Short hyphal filaments (4) Blastospores (5) Short Gram positive bacilli $\times 450$. (Liston and Cruickshank)

once or twice with a 1 per cent aqueous solution of gentian violet. Alkaline douches may help. Liston and Chisholm advise cleansing the vagina twice weekly by a solution of bicarbonate of soda, drying, and then painting vagina and vulva with a 2 per cent aqueous solution of gentian violet. If glycosuria is present the diet should be suitably modified.

REFERENCES

- ADAIR, FRED L., and HESSELTINE, H. C. *Am Jour Obst and Gyn*, 1936, 32, 1
 BLAND, P. B., WENRICH, D. H., and GOLDSTEIN, L. *S G O* 1931, 53, 759
 BROWNE, F. J. *Hospital Soc Service*, 1928, 17, 46
 BROWNE, F. J. *Jour Obst and Gyn Brit Emp* 1923, 30, 519
 DODDS, GLADYS H. *Jour Obst and Gyn Brit Emp*, 1927, 34, 779
 GAMMELTOFT, S. A. *Am Jour Obst and Gyn*, 1928, 15, 747
 GOLUB, L. J., and SHELANSKI, H. A. *Jour of Lab and Clinical Med (St Louis)*, 1937, 22, 1155
 GOODALL, J. R. *Canad Med Assoc Jour*, 1931, 25, 292
 HOLLAND, EARDLEY. "The Causation of Foetal Death" London, 1922
 LEES, D. *Brit Med Jour*, 1928, 11, 298
 LISTON, W. GLEN, and CHISHOLM, FANNY B. *Edin Med Jour*, 1911, 48, 433
 LISTON, W. GLEN, and CRUICKSHANK, LEWIS G. *Jour Obst & Gyn Brit Emp*, 1940, 47, 109
 MCGILGOR ROBERTSON, J. G. *Lancet*, 1933, 11, 1463
 MCKELVEY, J. L., and TURNER, T. B. *Jour Am Med Assoc.*, 1934, 102, 503
 PLASS, L. D., HESSELTINE, H. C., and BORIS, I. H. *Am. Jour. Obst and Gyn*, 1931, 21, 320

CHAPTER XXXV

THE USES AND VALUE OF RADIOLOGY IN OBSTETRICS

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THERE can be no doubt that radiology has proved its value in the field of obstetrics by affording information that may be difficult or even impossible to obtain by any other means. Its progress in obstetrics in Britain has been perhaps slower than in some of the other branches of medicine. This may be due to the fact that the older obstetricians have been able to do without its help and have by now acquired such a high degree of clinical sense that they feel they can obtain the information they want by their own hands. The younger generation on the other hand seems to be more mechanically or laboratory minded and makes more frequent use of these methods and whilst their employment leads to greater accuracy it is at the same time probably true that the clinical and tactile senses suffer in an inverse ratio. Be that as it may radiology will certainly be used more and more in this work as time goes on and practitioners become more familiar with its various uses. Its application to antenatal work is one of the factors to be considered in the problem of maternal and infantile mortality and also one for consideration in any national maternity service. Many modern general hospitals are now planned with a radiological unit adjoining the labour wards so that X ray examinations are immediately available with the least inconvenience to patients.

The various conditions in which the use of X rays may afford valuable help will now be reviewed though even at the present time it has to be admitted that the limitations as well as the advantages of this diagnostic aid are not yet clearly defined.

Pregnant or Not? The answer depends largely upon the age of the supposed gestation. In the earlier months radiology can offer little help because the foetal structures are usually not recognisable until about the 14th week but from the 16th week onwards it should be possible to form a definite opinion as to whether pregnancy exists or not. This is of importance in the



FIG. 6. Transverse lie. Two days previously the fetus was transverse lie with face downwards while at term the vertex presented.



11 68 And eye left is in vitro

T face p 541

whc

differential diagnosis between pregnancy and other pelvic tumours. Cases have been reported as having been detected much earlier than this but it may not always be easy to obtain exact information as to dates from patients.

Presentation In the routine examination two or three views are taken—an antero posterior and/or postero anterior and a lateral. The patient should be prepared by having her bowels cleared out by an enema and her bladder empty. The exposure should be as short as possible to avoid blurring of the foetal structures by any movements they may be showing at time of exposure or by the respiratory movements of the mother and the Bucky diaphragm or Lysholm grid used to cut off the secondary or fogging rays. In all obstetric radiological work accurate and skilful technique is absolutely essential in order to get the maximum amount of detail on the film and consequent less liability to error and this applies especially to the techniques of pelvimetry and cephalometry. It is sometimes asked whether there is any danger to the life of the child by the passage of X rays through it: there is none if the examination is carried out by a competent radiologist or radiographer but repeat examinations for the detection of a possible early pregnancy should not be done too often.

By means of these views the position and presentation can be determined though it should be realised that the position of the foetus may completely change between the time of examination and the onset of labour, especially if the examination is made some weeks before term (Fig 65). In vertex cases it can be made out whether the head is lying posterior or anterior whether it is engaging the pelvic brim or not and the degree of its flexion or extension. In the lateral view, the absolute position of the head may be difficult to determine and in these cases the wing shaped densities of the petrous bones if recognisable are good landmarks. In the case of a breech presentation it will be seen whether the legs are extended or flexed (Fig 66). A rough idea of the maturity of the foetus may even be formed but this is discussed more fully under the heading Estimation of Maturity (p 546).

Multiple Pregnancy This should be readily diagnosed from the routine films but it should be remembered that one of the foetuses may die early while the other or others develop normally and the dead macerated foetus may thus be missed (Fig 67). The lie and the relative position of the foetuses to each other and their are all to be seen. The finding of a multiple preg



FIG. 66 Lateral view of breech presentation with extended legs

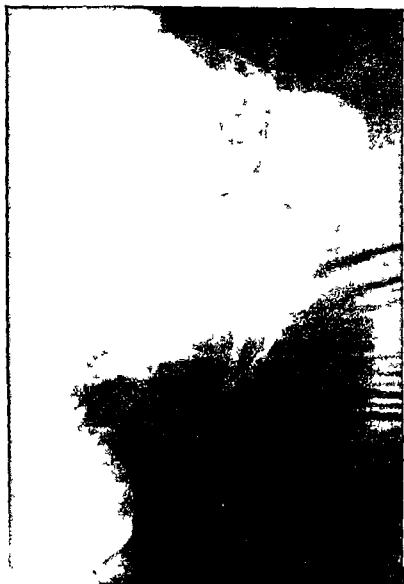


FIG. C7 Triplets the structures in the upper right corner are those of a macerated fetus



FIG. 68 Anencephal e fœtus in utero

differential diagnosis between pregnancy and other pelvic tumours. Cases have been reported as having been detected much earlier than this, but it may not always be easy to obtain exact information as to dates from patients.

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Fig. 70. Difficulty in getting the head to engage the brim was found to be due to a cervical fibroid. Epidural injection into uterus showed displacement to the right. Caesarian section.

This sign is of less value near term, as it may be confused with the moulding of the head which occurs when the latter enters the pelvis and to a more marked degree when labour commences. Overlapping at the frontal suture is stated to be never seen in a living foetus.

The death of the foetus should be strongly suspected when the foetal size is much smaller than would be expected from the period of gestation or when the foetus presents a characteristic "rolled up" attitude. The latter appearance is of special importance in non vertex presentations for in these Spalding's sign may be absent even though the foetus is dead. The cause of death is seldom recognisable, but occasionally syphilitic osteo chondritis of the long bones has been detected *in utero*.

Placenta Prævia The shadow of the placenta is seldom visible on the routine films, and in order to try to determine its position some method with contrast medium is sometimes employed. The method of Ude, Weum and Urner is to inject into the empty bladder *per urethram* a non irritating opaque solution, such as 12½ per cent sodium iodide, and is based on the assumption that when the head rests in the lower uterine segment there is, in normal cases, only a thin layer of soft tissues amounting to 0.8–1.5 cm, between the bladder and the foetal skull. If the head is displaced upward by a solid mass such as the placenta, the distance is increased up to 3 or 4 cm. Antero posterior and oblique films are made with the patient supine and the tube centred between the fundus of the filled, but not distended, bladder and the foetal head, while downward pressure is applied to the latter. The method is applicable only to vertex cases in the later weeks of pregnancy and is of value in determining the presence of placenta prævia in the anterior and antero lateral portions of the lower uterine segment. There may, however, be factors which make it misleading, such as the head not being down in the lower uterine segment, the presence of a blood clot between the head and the fundus of bladder, and the fact that the bladder embraces only a small anterior segment of the lower portion of the uterus but not the posterior and postero-lateral segments. It has been suggested that the injection of barium or air, as contrast media, into the rectum might show placenta prævia on the posterior aspects of the lower uterine segment.

Another method is the injection of an opaque contrast medium into the amniotic sac of an opaque sac. Abdominal wall as 20 c.c. of



FIG 71 Spalding's sign. Note the overlapping at the cranial sutures

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Another method is the injection through the abdominal wall into the amniotic sac of an opaque solution such as 20 c.c. of



Fig. 73 Amniogram showing site of placenta on left lateral wall of uterus
See accompanying diagram

due to the placenta, owing to the difficulty of determining with certainty the complete outline of the uterus, and the chief cause of this is gas in the intestines overlapping the uterine margin. It is usually necessary to take films from different angles in order to get the half tone shadow of the placenta "end on". Notwithstanding the difficulties, we have found the method to be of real diagnostic value in some selected cases. Caution must be observed as premature labour or even death of the fœtus may occur, and both have occurred in our experience. The use of this method, therefore, is not justified in every case of suspected placenta prævia and should not be employed before the 35th week of pregnancy. If some non toxic substance more opaque than Uroselectan and miscible with the amniotic fluid were available the method would become very valuable as the diagnosis of placenta prævia is of great clinical importance.

Direct Visualisation of the Placenta In 1934 Snow and Powell claimed to be able to demonstrate the placenta in ordinary films without using any special technique. Its most frequent site was at or near the fundus where it occupied about one third of the wall space of the uterus bulging in the centre to a depth of 7 cm including the uterine wall, and tapering toward the periphery. Dippel and Brown (1940) reported on the use of this method in 202 examinations made in 259 patients. They found the placenta clearly visualised in 90 per cent of the cases and no error in localisation was found in 53 of the cases subsequently verified by Cæsarean section or vaginal examination. Hydramnios was the chief interfering factor. Snow and Powell stated that the ventral surface of the fœtus almost always faces the placenta but Dippel and Brown were unable to confirm this. In 40 per cent of their cases the back of the fœtus and in some others the lateral surface faced the placenta.

Visualisation by Tomography Lloyd and Samuel have recently (1941) described the localisation of the placental site by Tomography—a method of radiography which aims at displaying a selected plane of the patient's body. The patient is put in the supine position and the pelvis raised by wool bags to bring the long axis of the uterus parallel to the film. An estimate is made of the mid point of the uterus and a tomographic film taken in the long axis of this plane. A film using a similar plane is made with the patient in the left lateral position. When difficulty is encountered in estimating the mid plane of the uterus two films

method depends on the thesis that the foetal cranium is, for practical purposes, an ovoid and every shadow cast by it is either ovoid or circular (Fig 74). If it be circular, it is the shadow cast by the section through the thickest part (greatest circular section) of the ovoid—a coronal section through the parietal eminences—and one of its diameters is the biparietal. If the shadow be ovoid, its short axis must represent some diameter of the greatest

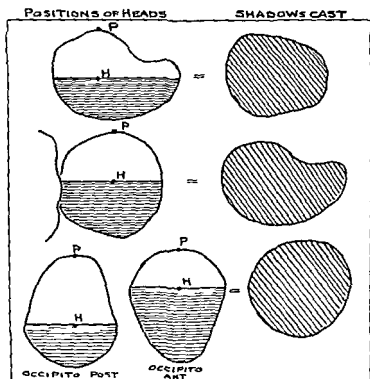


FIG 74 Cephalometry by method of Reece. Shadows cast by foetal head in various positions. P = position of head as ascertained by abdominal palpation. H = centre of mid plane of head.

circular section. The attitude of the foetal head is therefore not of importance, for every radiograph must show this short axis.

The examination is made with the patient supine and the exact position of the head is carefully determined. The tube is centred over this at a known height above the film. The distance between the tube and the head is measured and an allowance of $1\frac{1}{2}$ to 3 inches made for the distance between the palpable part

of the cranium and the centre of its short axis (Fig 75) By simple proportion (Fig 76), the actual biparietal diameter is estimated, and the maturity is obtained from the following table —

Biparietal Diameter.	Maturity.
3 00 inches . . .	32 weeks
3 30 inches . . .	36 weeks
3 75 inches . . .	40 weeks
Increase $\frac{1}{10}$ inch per week.	

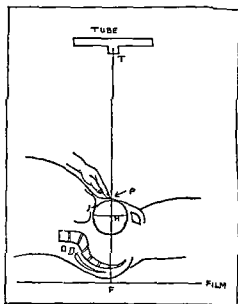


FIG 75

TP = Tube to palpated portion of head,
 TF = Tube to film
 PH = Allowance made for distance between palpated portion of head and the centre of its short axis

This method has the advantage that it depends on the biparietal measurement and so it is less likely to be influenced by the attitude of the head by tilting or by flexion or extension than the occipito frontal diameter is. Reece claims a considerable degree of accuracy for his method and this we can confirm.

McDonogh, also regarding the fetal head as an ovoid, independently devised a somewhat similar method. Two views are taken,

postero anterior and lateral with the patient preferably prone and the interval between the two exposures as short as possible. In the lateral view a graduated lead rule rests against the film so that the height of the head above the film in the postero-anterior view can be read off (Fig 77). Then by simple proportion the tube film distance being known, or by previously made scales the actual biparietal diameter of the foetal head is found.

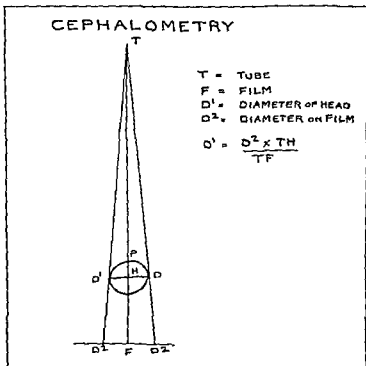


FIG 76 Formula for calculating actual diameter of foetal head

In Robert's method, the patient is examined in the prone position with the hypogastrum in as close contact as possible with the cassette or Lysholm grid and the tube centred over the foetal head at a fixed distance of 4 feet. The suboccipito bregmatic diameter is that most frequently seen on the resulting film, and this is measured by a ruler marked off in tenths of an inch. This diameter in inches (which corresponds to the biparietal at full term) when multiplied by 10, is stated to give in the majority of cases a fairly accurate estimate of the foetal maturity in weeks. For instance a suboccipito bregmatic diameter on the film of

37 inches indicates in an average case a maturity of 37 weeks. This method is applicable only to vertex cases during the last two months of pregnancy and in patients of average build whose hypogastria make contact with the cassette or Lysholm grid in the prone position.

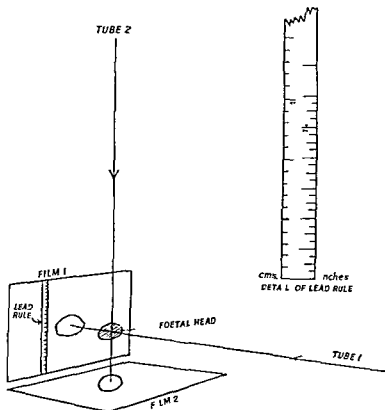


FIG. 100 Cephalometry by method of McDonogh. Relative positions of films, tubes and the foetal head.

Another method is based on the measurement of the foetal head by the cross thread method of Mackenzie Davidson, and the weight and maturity of the foetus estimated from the length of the occipito-frontal, or sometimes the biparietal diameter. Two exposures of the foetal head are made on the same film, the tube shift being 7 cm. at a known height above the film. By reconstructing the paths of the rays in the two exposures by means of strings, the actual diameter of the head, usually the occipito-

frontal, which cast the double shadow on the film can be measured. The occipito frontal or greatest diameter, having thus been determined, is then correlated to the weight of the foetus by means of a table prepared by Clifford (Table XII)

TABLE XII (Clifford)

Table for the Prediction of the Minimum and Average Body Weight to be expected from a given Occipito Frontal Diameter

Occipito-frontal diameter in centimetres.	Expected body weight.				
	English system.				Metric system.
	Minimum.		Average		
	lbs	ozs	lbs	ozs	grams.
11.5-12.0	6	0	7	10	2,727
11.0-11.5	5	0	6	8	2,267
10.5-11.0	4	0	5	4	1,814
10.0-10.5	3	0	4	4	1,360
9.5-10.0	3	0	3	8	1,360
9.0-9.5	2	8	3	0	1,150
8.5-9.0	2	0	2	8	907
8.0-8.5	1	8	2	2	700

Thoms' Method The shortest diameter of the foetal head can also be measured very simply by the method of Thoms, of placing an upright metal rod with a centimetre scale perforated in a lead strip posterior to the patient close to the fold of the nates and taking a lateral view of the pelvis.

The table on p. 552 is based on a large series of measurements made after birth at University College Hospital by Hastings Ince and correlated with birth weights.

Whatever method is employed for the estimation of maturity, it is obvious that as the size, weight, and state of ossification of full term foetuses vary considerably, it is possible only to give an opinion based on an average case and that our calculations must be, at times, inaccurate. Knowledge of the maturity is of considerable importance in cases complicated by toxæmia, heart disease, hæmorrhage or any other condition which might necessitate an early termination of pregnancy. When this question arises, it is the weight of the foetus rather than its maturity that the obstetrician is concerned with, and regarding this, cephalometry

TABLE XIII (HASTINGS INCE)

Biparietal diameter in inches	Observed.		Maximal weight.	Estimated weight.		Number of cases
	Minimal weight	Average weight				
	lbs. ozs.	lbs. ozs.	lbs. ozs.	lbs. ozs.		
2 75	3 0	3 0	—	2 15		1
2 95	2 10½	2 10½	—	3 13½		1
3 05	2 13	2 13	—	4 4		1
3 20	3 0	4 6¾	5 11½	5 0		6
3 25	7 0	7 0	—	5 3¾		1
3 30	3 9	5 5½	6 13	5 7½		15
3 35	4 6	6 0	7 9	5 11		18
3 40	4 6	5 14½	7 15	5 15		26
3 45	4 6½	6 4	7 14½	6 2½		49
3 50	4 4½	6 6½	8 14	6 6		77
3 55	4 14	6 12¾	8 9	6 10		77
3 60	5 0	6 14½	8 14	6 13½		110
3 65	5 0	7 1	9 3½	7 1½		125
3 70	4 15	7 1½	10 2	7 5		148
3 75	5 2¾	7 8¾	9 14	7 8¾		134
3 80	6 9	7 13¾	10 7	7 12½		84
3 85	5 13	7 12½	11 5	8 0		62
3 90	6 11	8 4	11 0	8 4		36
3 95	6 13	8 5½	10 8	8 7¾		23
4 00	7 7½	8 7½	9 13	8 11½		11
4 05	7 12	8 7½	9 5½	8 15¼		3
4 15	9 11	9 11	—	9 6½		1
4 25	9 5	9 5	—	9 14½		1

can give useful information with the help of a table such as that of Clifford or Hastings Ince

Types of Female Pelvis A full description and classification of these is given in Chapter XVIII, p 258 and it is recognised generally that each of the types may show minor characteristics of any of the others and that there are differences in size of the main types. There are also deformities of the pelvis due to disease such as rickets, tuberculosis, etc., or due to gross fracture. Again, a pelvic tumour such as an ovarian dermoid (Fig 78) or a bony outgrowth from the pelvic walls may exist. The previous knowledge of the type of pelvis and the existence of any of these pathological conditions is of the greatest importance to obstetricians.

Caldwell and Moloy have definitely shown that the type of pelvis exerts an appreciable effect on the mechanism of labour



FIG 78 Pregnancy complicated by ovarian dermoid containing teeth



FIG 79 Lateral view showing relation of head to sacral promontory and symphysis pub

Much of their work was done or confirmed by stereoscopic antero-posterior radiographs taken during the different stages of labour when the exact reproduction of the pelvis, the foetal pelvic adaptation and the true pelvic diameters were observed and measured in the "precision stereoscope" (see p 559) They complete their survey with a 45° angle view of the subpubic arch and a lateral view of the pelvis unless labour has started

Internal Pelvimetry The measurements of the diameters of the pelvic inlet can be estimated with considerable accuracy by X rays though the estimated diameters are those of the bony pelvis (the soft parts being radio transparent) and thus similarly applies to the diameters of the foetal head The pelvic measurements are of more importance from the point of view of delivery than the cephalic ones, as anomalies of the foetal head are rare compared with the many types of shape and abnormal size of the maternal pelvis, also the foetal head is mouldable whereas the maternal pelvis is relatively rigid even allowing for the widening of the symphysis and of the sacro iliac joints during pregnancy It is rare to have a head too large for a normal sized pelvis—difficulty is much more likely to be caused by an average sized head and a contracted pelvis The ideal would be to have both of these measurements together with a survey of the pelvic cavity By the knowledge of the relationship between the foetal head and the pelvis before labour, some of the difficulties which sometimes arise during labour should be prevented and both the infantile and maternal mortalities reduced In this connection it would be well to refer to the heading *Obstetric Prognosis*

A true lateral view of the pelvis, with the tube centred over the upper border of the great trochanter and a pillow placed between the knees, is of great value in showing the general shape of the pelvis, the plane of the brim the true sacral promontory the curvature of the sacrum and its inclination to the brim and the shape of the sacro sciatic notches (Fig 79) Accurate measurement of the true conjugate may be made from this view by a notched metal ruler placed in the gluteal cleft or by the same method of calculation as that to be described immediately (see Fig. 80) and checked, if need be, with the measurement in that view The measurements of the pelvic outlet are usually determined by manual examination but more accurate estimations can be obtained by X rays

The value of most radiological methods is to supplement the

information given by other methods and not to replace the clinical examination. On many important points in obstetrics, X rays can give no information at all, e.g., the condition of the soft parts within the pelvis, the uterine contractions etc., which are determined only by manipulation and observation. It is therefore of the utmost importance that there should be at all times a

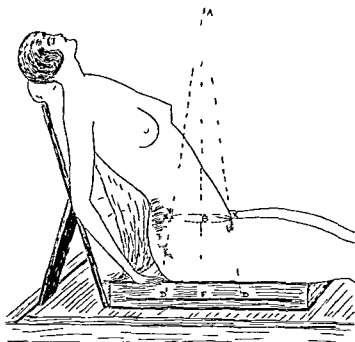


FIG 80 Internal pelvimetry by method of Roberts

$$XX' DD' = AB \cdot AF, \text{ i.e., } XX' = \frac{AB}{AF} \times DD'.$$

generous liaison between the obstetrician and the radiologist when the difficulties of each and problems interesting to each may be frankly discussed. Sometimes there seems to exist a watertight compartment atmosphere in hospitals, where indeed most of the obstetric radiological work is done, to the great detriment of each of these departments as well as of the patient.

There are three main methods employed in pelvimetry —

- (a) Triangulation method
- (b) Scale or Frame method
- (c) Stereoscopic method (measurement of the phantom image)

One of the simplest methods is that described by Roberts. The brim of the pelvis is placed parallel to the film with the central ray passing vertically to the plane of the brim and through its centre and the resulting radiograph is a symmetrically enlarged picture of the pelvic brim. If the distances of the brim and of the film from the target of the tube are measured, a simple sum in proportion will give the actual diameters of the brim (Fig. 80). The patient is examined in the half reclining position with her legs stretched out in front and her shoulders resting on a bed rest. The angle of the bed rest is adjusted until the brim of the pelvis is horizontal, *i.e.*, parallel to the film. This is usually so when an imaginary line between the upper border of the symphysis and the lower border of the fourth lumbar spine, as delimited by callipers, is parallel to the film.

Another method is that of Rowden whose technique may be summarised as follows.—The patient sits on a Sectogrid Potter Bucky with her legs hanging down and her back against a bed rest set at 55° to the horizontal. This is said to bring the pelvic brim practically parallel to the film. The centre of the patient's pelvis should approximately coincide with the ball bearing of the Sectogrid, the tube is centred over this point at a height of 4 feet 6 inches above the film and the exposure made. With the patient in the same position the distance between the superior edge of the symphysis pubis and the surface of the Bucky is measured by callipers. A series of "pubic scales" are at hand, having previously been prepared thus.—A strip of lead supported by plywood has small holes drilled down the centre exactly half an inch apart. This is placed at various distances— $4\frac{1}{2}$, 5, $5\frac{1}{2}$ etc., inches—above the surface of the Bucky and films made at each of these distances with the tube $4\frac{1}{2}$ feet above the film, *i.e.* the same height as when the patient is examined. The developed and dried films constitute the "pubic scales." Their application is as follows.—Suppose the measured distance between the patient's superior pubic edge and the surface of the Bucky is 5 inches, then the corresponding pubic scale of 5 inches is placed alongside the radiograph of the patient and the real diameters of the pelvic brim are measured by reference to the dots on the pubic scale, which represent $\frac{1}{2}$ inch distances.

The method of Thoms has similarities to each of the two just described. The position of the patient is the same as in the first while instead of the "pubic scales" of the second, a lead grid

perforated with holes accurately in a centimetre pattern is used. After the exposure of the patient's pelvis has been made she is removed and the grid is placed in the exact position of the plane of her pelvic inlet and a short exposure through the grid immediately superimposed on the film. The developed film shows the pelvis dotted with the perforations of the grid and as the grid was at the same distance as the pelvic brim from the film the diameters of the brim can be read off from the dots which represent corrected centimetres. A somewhat similar method is that of Orley.

Thoms has further devised a method by which the image on the

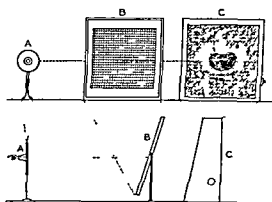


FIG. 81. Diagrammatic representation of Thoms pelviscope.
A eye piece B glass centimetre screen C viewing box

radiograph can be recorded on ruled paper in its correct measurements. The apparatus named the pelviscope (Fig. 81), in a way reconstructs the conditions when the exposure with the grid was made. The film is placed against an upright viewing box; a sheet of glass ruled in centimetre squares (representing the grid) is placed some distance in front and an eye piece with a small aperture (representing the tube anode) is placed still further off. One looks through the eye piece and moves the glass sheet until the intersections of its lines exactly superimpose the 'corrected centimetre dots' on the radiograph. The outline of the pelvic brim is next traced on the ruled glass with a skin pencil and will be in true proportion. It is then a simple matter to trace on a sheet of centimetre squared paper the drawing on the glass.

Thoms and Wilson have lately introduced a modification of

Thoms grid method the purpose of the modification being that in the antero posterior view the transverse diameter of levels other than that of the pelvic inlet may be measured. For both views the target film distance is 36 inches. For the lateral view they use the upright posture and the upright centimetre rod. The lateral projection is taken first as follows.

(1) The patient puts on heelless slippers and the usual hospital bed gown open at the back.

(2) She is placed standing in front of an erect Bucky diaphragm or an adjustable cassette changer such as is used for chest work with one lateral aspect of the body toward the target. The arms are folded across the chest.

(3) The target film distance is 36 inches and the target is centred just below a point on the external conjugate diameter one third the distance from the symphysis pubis to the defence under the fifth lumbar vertebra.

(4) A binder is placed around the patient and attached to the cassette changer to ensure steadiness during the exposure.

(5) Before the exposure is made an upright metal rod (galvanised iron) with a centimetre scale perforated in a lead strip is placed posterior to the patient close to the fold of the nates.

(6) The time of exposure varies with the thickness of the patient, all other factors being constant. In general the time is from 7 to 12 seconds.

When the film is developed and viewed the following landmarks should be readily identifiable: anterior and posterior borders of symphysis pubis; acetabula; ischial spines; ischial tuberosities; the lower lumbar vertebrae; the promontory; and anterior surface of the sacrum and the sacro-sciatic notch. On one edge of the film may be seen the shadows cast by the perforations giving corrected centimetres in the sagittal plane of the patient. By means of callipers using this scale any diameter in this plane may be measured. When the picture is taken at term or in labour the relation of the presenting part to the brim can be studied and the shortest diameter of the fetal head measured. Thoms' recent modification of his centimetre grid method for pelvic inlet pelvimetry is as follows:—

(1) The patient is placed on the roentgenographic table in a semi-recumbent position which is maintained by a backrest. In plain language the patient in position an attempt is made to have the pelvic inlet horizontal.

(2) The level of the pelvic inlet above the sensitive film is established as follows (a) by means of callipers the vertical distance is measured from some point on the table top to a point on the anterior surface of the symphysis pubis 1 cm below its upper border (b) By the callipers the distance is determined from the interspinous space between the fourth and fifth lumbar



FIG 8° Inlet roentgenogram of pelvis The scale at the top represents corrected centimetres for the pelvic inlet and other levels of the pelvis (Thoms)

vertebrae to the table top. The imaginary line joining these two points on the patient's body should be parallel to the film and if necessary the patient's position is adjusted to bring this about.

(3) The tube is centred in the mid line 6 cm posterior to the upper border of the symphysis pubis and the exposure is made.

(4) The patient is removed from the table, the tube and exposed film remaining *in situ*.

(5) The centimetre grid, a lead plate with perforations along one edge, is introduced into the same plane as that previously

occupied by the pelvic inlet, and a second flash exposure made on the edge of the previously exposed film. This is done after moving the target so that it rests directly over the perforations in the grid, still maintaining the 36 inch distance.

In viewing the inlet film the pelvic inlet, ischial spines and pelvic side walls of the outlet are seen. At the top edge of the film are the projected perforations of the grid representing corrected centimetres for the various levels in the pelvis (Fig. 82). The line of corrected centimetres at the top represents the level of the pelvic inlet and this scale is used in measuring the antero-posterior, transverse and posterior sagittal diameters of the inlet. The five rows of perforations which are seen below this level are those to be used respectively for the 5, 6, 7, 8 and 9 cm. levels below the inlet. Thus if we wish to measure the interspinous diameter on this film we find the level of the ischial spines in the lateral film by measuring downward from the level of the pelvic inlet. If, for instance, this is 6 cm., then on the antero-posterior film we use the third or 6 cm. calibration for the determination.

Another method, made practical by Caldwell and Moloy is by stereoscopic radiographs taken with the patient supine and a pad under the lumbo-sacral region to tilt the pelvic brim more nearly parallel to the film and the tube centred over the mid point between the anterior superior iliac spines. Every care is taken by means of markers on the cassettes and others to each side of the symphysis pubis to ensure that when the films are examined in the stereoscope they are viewed in exactly the same relative position as when the exposures were made. If an accurate reconstruction is made the stereoscopic image will be viewed in a position corresponding to that of the living part and accurate measurements in all three dimensions are obtainable.

The optical system of the stereoscope used consists of two glass cubes with half-platinized surfaces set at an angle of 45° to the axis of the instrument and through which the observer visualises the phantom image against a dark background. Means must also be provided to compensate for the variations in interpupillary distances of different observers as compared with the tube shift distance used and this is done by the adjustment of an auxiliary pair of rhomboid prisms. These modifications constitute the main differences between the precision stereoscope (Fig. 83) and an ordinary stereoscope.

The pubic markers, at a known distance apart, serve as a further

The bi parietal diameter is then shown in the film. To demonstrate overlap a lateral radiograph is taken with the patient standing up and leaning forward with her hands grasping the back of a chair. A line is drawn on the developed film joining the promontory of the sacrum to the top of the symphysis pubis. This line is of course, the true conjugate diameter. A perpendicular to the true conjugate is now erected at both ends of it thus forming the sides of a box (Fig 84). When the fetal head fits

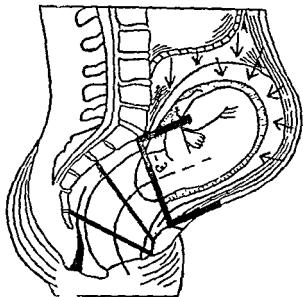


FIG 84 Diagram showing perpendicular lines erected at extremities of true conjugate to form sides of box (O Sullivan and Crawshaw)

easily between the perpendicular lines it can be safely assumed that it will go through. If it is equal to the true conjugate it will only go through with moulding. The film should of course be taken at term, or better still in the first stage of labour as the head is then more likely to have assumed the lateral position.

Obstetric Prognosis near Term or During Labour The attempt to estimate the practical value of X ray pelvimetry and cephalometry is well worth the consideration of the obstetrician and the radiologist though in practice the former is the one who has the better opportunity to check the information given by the other. The principles of prognosis must always be difficult because the analysis of the shape of pelvis and size of its diameters, the position and size of the head and the adaptation of the one to the other

during labour, depends not only on the proper correlation of these facts and figures, but also on another very important but unknown factor—the dilating and expulsive force of labour

Moloy and Swenson recently (1938) published their summing up of the present position. They demonstrate by means of the pelvic inlets of two different types of pelvis superimposed one on the other that each of the pelves may have exactly the same antero posterior and the same transverse measured diameters of their inlets, yet one of the pelves is an ample gynecoid type with a good obstetric prognosis while the other is an extreme android type and particularly unfavourable for delivery by the vaginal route. This would indicate that to depend only upon the measurements of these inlet diameters may not only fail to show the obstetric significance of the pelvis but may even give an erroneous impression regarding the ease or difficulty in labour. If their premises are correct, much less value than hitherto must be attached to measurements of the antero-posterior and transverse diameters of the brim.

These observers prefer to determine the prognosis by means of stereoscopic radiographs when the shape and size of the entire pelvis, and the foetal head, particularly its position, size and shape with respect to the inlet, can be studied. Disproportion between the head and the pelvis can be recognised by this means without recourse to cephalometry. In the majority of cases, they consider that accurate measurements of the pelvis and head are not necessary and that the ordinary stereoscope is quite sufficient for routine work. The precision stereoscope offers a distinct refinement in diagnosis but they do not consider it essential. In other words, the ordinary stereoscope enables one to recognise all the important factors except the actual measurements of the pelvis and the foetal head.

REFERENCES

- CALDWELL, W. E. and MOLOY, H. C. *Am Jour Obst and Gyn*, 1933 26 479
 CALDWELL, W. E. and MOLOY, H. C. *Proc Roy Soc of Med* 1934-5, 32,
 No 1 1
 CLIFFORD, S. H. *S G O* 1934, 58, 727
 CLIFFORD, S. H. *S G O*, 1934 58, 939
 DIPPEL, A. L. and BROWN, W. H. *Amer Jour Obst and Gyn* 1940 40 986
 INCE J. G. HASTINGS. *Jour Obst and Gyn Brit Emp*, 1939 46 1003
 KERR J. M. MUNRO and MACKAY D. G. *Trans Edin Obst Soc*, 1932-3, 53
 21
 LLOYD O. and SAMUEL, ERIC. *Jour Obst and Gyn Brit Emp*, 1941, 48,
 499
 McDONOUGH C. L. *Brit Jour Radiol*, 1935 8 613

- MOLOY and SWENSON "Diagnostic Roentgenology" Thos Nelson
Chap X, 755
- ORLEY, A *Brit Med Jour*, 1938 ii, 284
- O SULLIVAN, J V, and CRAWSHAW, F M *Brit Med Journ.* 1941 ii, 543
- RLEECE L N *Proc Roy Soc Med London* 1935, 28, 45
- ROBERTS, R E *Brit Jour Radiol*, 1935, 8, 601.
- ROBERTS, R E *Brit Jour Radiol* 1927, 32, 11
- ROBERTS, R E *Proc Roy Soc Med London* 1934 27 51
- ROWDEN, L A *Brit Jour Radiol* 1931 4, 432
- SNOW, WILLIAM, and POWELL, C B *Amer Jour Roentgenology* 1934 31, 37
- THOMS, H *Jour Am Med Assoc* 1930 95, 21
- THOMS, HERBERT, and WILSON, HUGH M *Yale Journal of Biology and Medicine*, 1941, 13, 831
- UDE W. H, WEEM, T W, and LUNER J A *Im Jour Roentgenology and Radium Therapy*, 1934 31, 231

CHAPTER XXXVI

POSTNATAL CARE

IN this chapter it is not our object to discuss in detail the care of the living in woman but rather to describe the conduct of the postnatal clinic¹ as it has been developed in recent years, and the ways in which it can be used to diminish morbidity following childbirth. That there is widespread maternal disablement as a direct or indirect result of child bearing there can be no doubt. Blair Bell estimates that each year in England and Wales at least 60 000 women, that is 10 per cent of all mothers, are more or less crippled as the result of childbirth. Miller, in a follow up of 2 000 women in the Edinburgh postnatal clinic, found that 70 per cent were satisfactory and 30 per cent unsatisfactory, i.e., suffered from disabilities of various kinds, such as leucorrhœa, backache, subinvolution, prolapse, retroversion or various lesions of an infective nature, such as cervicitis. If we assume such results to be typical of those existing in other centres we are forced to conclude that over 100 000 women yearly suffer in greater or less degree from disabilities following and resulting from child bearing. It is true that many of these complaints are of a minor nature, and that in many cases the patient might recover completely and permanently and might thus have escaped inclusion if the examination had been carried out at a later period. On the other hand, some patients that are classed as satisfactory as a result of examination in the earlier weeks or months after delivery might develop serious illness at a later period. Thus about 4,000 women die annually from cancer of the cervix in England and Wales alone, and fully 95 per cent of these occur in women who have borne children. It is generally agreed that parturition and its associated cervical lacerations and infections are important predisposing causes of cancer of the cervix, so that this disease

¹ Special *ad hoc* postnatal clinics are no longer held in University College Hospital. Instead and at the express wish of the obstetric unit staff a system has gradually been elaborated by which members of the staff are each responsible for his or her own patients throughout pregnancy, labour and the postnatal period. Thus there is continuous responsibility for individual patients. Postnatal patients therefore, return to the antenatal clinics on the same day of the week on which they attended the antenatal clinic, and are there seen by the officer who attends the clinic on that particular day and who looked after them during pregnancy and labour. This adds much to the interest of the work and both patient and doctor are correspondingly benefited.

must be regarded as one of the later developing lesions. Genital prolapse is obviously in the same category. It would seem, therefore, that Blair Bell's estimate of 60 000 women more or less disabled yearly is a fair and moderate one.

Further important information can be obtained by examining statistics from gynaecological hospitals. Thus at the Royal Samaritan Hospital for Women Glasgow, in the years 1928-1929 and 1930 there were 7 734 patients treated. In 2 178 (28.1 per cent) of these, infection associated with childbirth was an etiological factor in the condition for which they were treated while injury during childbirth was an etiological factor in 2 730 (35.3 per cent). In over 60 per cent, therefore the disability which necessitated treatment owed its origin to child bearing. Blair Bell found that at the Royal Infirmary, Liverpool during the six years 1925-1931, 47.3 per cent of all gynaecological operations were concerned with the relief of local injuries and infections and of 2,275 consecutive parous women seen in the gynaecological out-patient department 775 (34 per cent) were suffering from disablement due to pregnancy or parturition. Of these, 627 (80.8 per cent) had traumatic or infected lesions including such conditions as pelvic peritonitis and cellulitis salpingitis, cervicitis, etc. Among the remaining 148 there were 112 cases of cancer of the cervix. As Blair Bell points out, these represent only the more serious complaints for which women seek advice. The importance of puerperal sepsis as a cause of sterility is suggested by Méave Kenny, who found that of 100 women who had suffered from that disease only five conceived in the following five years.

The diminution of this high incidence of maternal disablement is, of course, largely a matter of adequate antenatal care of good and conservative obstetrics, and of proper nursing in the puerperium. In this chapter we are concerned only with the measures at our disposal for successfully combating it in the postnatal clinic.¹

The First Postnatal Examination

Every patient should be examined at the end of the lying-in period usually, therefore, ten to fourteen days after delivery.

A suitable form for keeping the record is shown in Appendix B. Attention is particularly directed to the state of the abdominal

¹ See footnote on p. 564.

valls and per neum the healing of sutured tears the presence quantity and colour of lochial discharge the state of the cervix (lacerated or patulous) the position and involution of the uterus the condition of the appendages and the presence and site of tenderness in the pelvic organs generally If there is marked subinvolution and especially if there is much tenderness not to speak of other signs of inflammatory trouble such as swelling in the tubes or parametritis it is always well to advise the patient to remain at rest and under observation until it has cleared up or considerably improved Should there be retrovers on of the uterus it should be replaced bimanually (p 500) but without the insertion of a pessary The patient if allowed home is given a mixture containing ergot and if she is anæmic Blaud's pills gr xx xxx thrice daily should be prescribed in addition She is also advised to douche herself daily with hot water at a temperature of 110° 115° in which common salt is dissolved in the proportion of two tablespoonfuls to one pint Should she remain in hospital she should be douched twice daily with the same solution and kept in bed and sitting up if possible in the open air

The blood pressure is recorded as a routine at this first postnatal examination and the urine tested for albumin If albumin is found a catheter specimen must be obtained The significance of a high blood pressure and of albuminuria at this time is discussed elsewhere (pp 346 *et seq*)

The record of the examination is kept and filed with the obstetric history and as part of it

The Second Postnatal Examination

In normal cases this should take place at the postnatal clinic ¹ six weeks after delivery The record of this examination is made on a special form a suitable one being that in use at University College Hospital (Appendix C) The form speaks for itself and reference need only be made to a few points of special importance

Blood Pressure This should be recorded at each visit even though it has been normal in pregnancy for Stout has shown that in some such cases hypertension is discovered some weeks after delivery If albumin is found in the urine a catheter specimen must be obtained

Cervicitis The cervix should be exposed through a speculum

¹ See footnote on p 564

in every case so as to determine the exact site and extent of the disease. This should certainly be a routine procedure at the second examination six weeks after delivery, and its importance has been especially emphasized by Miles Phillips. There can be no doubt that lacerations and infections of the cervix often give rise to minor degrees of discomfort and disability. Goff states that about 40 per cent of primiparæ have significant injuries to the cervix after labour, and Fulkerson states that *endocervical infections* are found in 93 per cent and 7 per cent of multiparæ and primiparæ respectively. This indicates the importance of the traumata of labour in the causation of cervical infections.

Cervicitis is well recognised as a cause of *leucorrhœa*, backache, and abdominal pain, while it is probable that it may act as an infective focus from which may originate such conditions as rheumatism, rheumatoid arthritis, iridocyclitis, etc. It is generally believed, too, that cervical lacerations and *cervicitis* are important predisposing causes of cancer of the cervix.

A considerable amount of evidence has accumulated within recent years of the prophylactic value of treating *cervicitis* and cervical lacerations. Smith, Smithwick and Rogers state that of 550 cases of cancer of the cervix none gave a history of previous cauterisation, and that of 1,150 in whom cauterisation of the cervix had been carried out from January, 1914, till January, 1927, not one was known to have developed cancer. Pemberton and Smith found that of 3,814 patients on whom trachelorrhaphy had been done only five developed cervical cancer, while of 1,408 patients whose cervix had been cauterised, and 740 in whom the cervix had been amputated, none developed cancer. Only 21 out of 669 patients with cancer of the cervix had had previous trachelorrhaphy and none had cauterisation or amputation. These experiences suggest that careful treatment of cervical tears and of *cervicitis* might play an important part in the prophylaxis of cancer of the cervix, in addition to preventing and curing many minor discomforts and disabilities such as backache and *leucorrhœa*.

If, therefore, *cervicitis* is found, it should if possible be treated by the electric cautery, though some prefer diathermy. Topical applications are of much less value, as they merely reach the surface of the cervix, and cannot penetrate into the deeper tissues and glands that are involved in the inflammatory process. In

walls and perineum the healing of sutured tears the presence, quantity and colour of lochial discharge, the state of the cervix (lacerated or patulous) the position and involution of the uterus the condition of the appendages, and the presence and site of tenderness in the pelvic organs generally. If there is marked subinvolution and especially if there is much tenderness, not to speak of other signs of inflammatory trouble such as swelling in the tubes or parametritis it is always well to advise the patient to remain at rest and under observation until it has cleared up or considerably improved. Should there be retroversion of the uterus it should be replaced bimanually (p. 570) but without the insertion of a pessary. The patient if allowed home is given a mixture containing ergot and if she is anæmic Blaud's pills gr. ʒi xxx thrice daily should be prescribed in addition. She is also advised to douche herself daily with hot water at a temperature of 112°-115°, in which common salt is dissolved in the proportion of two tablespoonfuls to one pint. Should she remain in hospital she should be douched twice daily with the same solution and kept in bed and sitting up, if possible, in the open air.

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A considerable amount of evidence has accumulated within recent years of the prophylactic value of treating cervicitis and cervical lacerations. Smith, Smithwick and Rogers state that of 350 cases of cancer of the cervix none gave a history of previous cauterisation, and that of 1,150 in whom cauterisation of the cervix had been carried out from January, 1914, till January 1927, not one was known to have developed cancer. Pemberton and Smith found that of 3,814 patients on whom trachelorrhaphy had been done only five developed cervical cancer, while of 1,408 patients whose cervix had been cauterised, and 740 in whom the cervix had been amputated, none developed cancer. Only 21 out of 669 patients with cancer of the cervix had had previous trachelorrhaphy and none had cauterisation or amputation. These experiences suggest that careful treatment of cervical tears and of cervicitis might play an important part in the prophylaxis of cancer of the cervix, in addition to preventing and curing many minor discomforts and disabilities such as backache and leucorrhœa.

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the more severe cases especially those associated with ectropion (eversion of the anterior and posterior lips) plastic repair or amputation may be preferable though operative measures are, as a rule better postponed till the end of child bearing life To expose the cervix through the speculum the lithotomy position is easily adopted in hospital where a suitable couch is available In private practice however the Sims position gives excellent exposure Indeed it is often preferable if the vaginal walls are lax as in the Sims position the vagina is distended by air and its walls widely separated The cautery too can be easily used in this position

Method of Cauterising the Cervix In most cases six radial incisions with the cautery, each about $\frac{1}{8}$ to $\frac{1}{4}$ inch in depth are necessary three on the posterior and three on the anterior lip of the cervix and all can be made at one sitting As the cervical canal is usually involved in the disease it is a good plan to start the cautery at the internal os bring it down the canal with a firm stroke and then outwards over the lip of the cervix as far as the erosion extends A general anæsthetic is not required Very seldom indeed does the application of the cautery cause any discomfort but if it does it is usually advisable to desist at once and lay a swab soaked in 10 per cent solution of cocaine against the cervix for five minutes after which it is always possible to proceed with the cauterisation The patient should be asked to return six weeks later when it may be necessary to touch up one or two areas of erosion still remaining In the meantime she should douche her vagina with warm salt solution two teaspoonfuls to the pint and should be warned that there may be some temporary increase of discharge or even slight bleeding Severe hæmorrhage rarely occurs during separation of the slough—according to Matters in less than 2 per cent of cases

Bourne has recently advocated the treatment of cervicitis by a caustic in the form of a saturated solution of zinc chloride. This is applied to the cervical canal by means of a porous clay pencil (obtainable from Allen & Hanbury) which is soaked in the solution for ten minutes immediately before application The pencil which is usually about $1\frac{1}{2}$ inches long and $\frac{1}{4}$ inch thick is inserted into the canal until its proximal end is flush with the external os. A strip of gauze soaked in a 5 per cent solution of sodium bicarbonate to neutralise any acid that escapes into the

vagina is packed around the cervix and firmly over the external os. The pencil is left in position for two to four hours and in the meantime the patient is kept lying down. The mucosal slough separates at the end of a week to a depth of 2 to 4 mm and at the end of four weeks all discharge has usually ceased, the canal eventually becoming completely lined by new epithelium. Of 41 cases treated 27 were cured, 11 were improved and 3 were no better.

We feel that the exposure and, when necessary, the treatment of the cervix is by far the most important procedure in the postnatal clinic, much more so than the correction of retroversion and that unless it is done as a routine the postnatal examination must largely fail to fulfil its purpose.

Vaginal Discharge without Cervicitis. Not infrequently in the postnatal period, just as in ordinary gynaecological practice, a patient is found to have a vaginal discharge although the cervix is apparently healthy. This arises from a vaginitis which may or may not be caused by the trichomonas vaginalis and the discharge should always in such cases be examined for this organism (p. 335). Even when it cannot be found, cure of the vaginitis may often be effected by the use of picric acid pessaries with or without paraffin insufflation.

Prolapse. Should slight degrees of cystocele or rectocele be found, relief can usually be given and in most cases a permanent cure effected by exercises designed to strengthen the pelvic floor. Suitable ones are those described on p. 574.

Retroversion of the Uterus. This condition is a not uncommon sequel of parturition and though it is doubtful whether it often gives rise to any serious disability when unassociated with other pelvic abnormalities such as infections, prolapse, etc., there can be no doubt that it not infrequently gives rise to backache and general pelvic discomfort. Miller found it in 18 per cent. of 2,000 cases seen five weeks after delivery at the postnatal clinic in the Edinburgh Royal Maternity Hospital. It is of interest to note that it was only present in 8 per cent. at the time the patient left hospital.

F. W. Lynch investigated 1,230 women not earlier than four and not later than twelve months after delivery. He found retroversion in 41 per cent. Like Miller, he found that the uterus might be normally placed when the patient leaves hospital a fortnight after delivery, but become retroverted subsequently. Of his cases 28 per cent. were discovered within the first month,

26.5 per cent in the second month 12.5 per cent in the third month 9 per cent in the fourth month 18 per cent in the fifth month and 6 per cent from the eighth month to the twelfth. These findings show that if retroversion is to be discovered early and at a stage when it is curable by pessary treatment postnatal examinations must be carried out at intervals for the first year after delivery. Seventy per cent of Lynch's cases were cured by the use of the pessary left in for two to six months.

In the *prevention of retroversion* in addition to measures directed to promote involution and early treatment of the condition in the *postnatal period* there can be no doubt of the importance of getting the patient to sit up early in the puerperium and from the third day getting her to lie for a certain time daily in the prone position. It is important too to avoid distension of the bladder which is particularly liable to occur during the lying-in period.

Should retroversion be discovered at the second or subsequent postnatal examination the uterus should be replaced bimanually and a Hodge pessary inserted. This should be changed every three months and may usually be discarded altogether at the end of six to nine months. While wearing it the patient should use a daily douche of warm hypertonic saline (2 teaspoonfuls to each pint of water) at 112° to 115° and the bowels should be kept freely open—preferably by the use of a saline purgative. If there is *anæmia* iron should be given.

Methods of Replacing the Retroverted Uterus Replacement of the retroverted uterus in the postnatal period may sometimes present difficulty. The bladder and rectum should always be emptied before attempting it. An attempt should first be made to replace it by the ordinary bimanual method *i.e.* pushing the cervix backwards towards the sacrum and thus tilting the fundus forwards until the external fingers can be placed behind the body of the uterus which is then pushed forward by the external hand. For this manoeuvre we prefer the patient in the dorsal position. Sometimes however as the portio vaginalis is very short and the entire uterus soft and flabby this method is not successful. It is then a good plan to put the patient in the knee-chest position pass a Sims speculum grasp the anterior lip of the cervix with a volsella and draw the cervix gently downwards and backwards towards the sacrum. The fundus then falls forward. The patient is replaced in the dorsal position and the volsella removed.

Sometimes in addition to the retroversion there is subinvolution

recognised by undue prolongation of red lochia and large size of the uterus, which is often tender. In such cases the douche above described should be used twice morning and evening and the patient should be advised to rest for at least two or three hours daily. Small doses of ergot should be prescribed and if there is anaemia, iron preferably in the form of Bland's pills gr xx xxx , three times daily.

Chronic Backache This is a fairly common complaint during the postnatal period. The backache may be felt on first getting up, or its onset may be delayed for some weeks. Its causes are various and may be classified as follows —

(1) *Backache Due to Pathological Changes in the Pelvic Organs*
 (a) *Retroverted Uterus* This is sometimes accompanied by backache, though probably the backache is not often due to the retroversion itself but to some associated pathological condition such as salpingo oöphoritis, etc. Occasionally however it seems to be due to the retroversion itself. If backache occurs in a patient who has a retroverted uterus and if no other cause can be found to account for it the uterus should be replaced (p. 570) and a Hodge pessary inserted to maintain it in position. If when the patient is seen again later, the backache has disappeared it may be assumed that the retroversion was the cause of it. Provided the displacement has been corrected early in the postnatal period, wearing a pessary for six months will usually effect a permanent cure (p. 570). If it does not do so and the retroversion recurs, with return of the backache when the pessary is removed ventro suspension of the uterus by shortening the round ligaments should be considered.

(b) *Inflammatory lesions in the uterine appendages (salpingo oöphoritis) or in the pelvic cellular tissue (parametritis)* There may, in this condition be more or less constant backache which is felt chiefly over the posterior surface of the sacrum and is not relieved by lying down. It is usually accompanied by pain in the right and left iliac fossæ and hypogastrium the pain being referred from the pelvis along the distribution of the ilio hypogastric and ilio inguinal nerves. On manual examination will reveal the swelling at the side of or behind, the uterus. The treatment is that of the causal lesion and will not be further discussed here.

(c) *Cervicitis* often gives rise to low backache felt over the sacrum. The treatment is discussed on p. 567.

(d) *Early prolapse* such as is sometimes present in the post natal period may give rise to backache which is worse after prolonged standing and is relieved by lying down (p 569)

(2) *Backache Due to Pathological Changes in the Urinary Tract* The pain in this is usually a dull ache in the lumbar region not relieved by lying down and is often accompanied by tenderness in the right or left costo vertebral angle. There may be a history of pyelitis during the pregnancy immediately preceding and this may give a clue to the diagnosis. In all cases of chronic backache after childbirth the investigation should always include an examination of the urine for pyelitis (p 484) and a pyelogram to exclude pathological changes in the kidney pelvis and in the ureters. The treatment of chronic pyelitis is discussed on p 490.

(3) *Backache Due to Functional Muscular Insufficiency* There are several reasons why muscular insufficiency should arise in the postnatal period. In the first place during the last month of pregnancy there is more or less lordosis and after getting up and the re-assumption of the normal posture there is often a temporary failure of re-adjustment of muscular action especially of the latissimus dorsi and sacro spinalis. Secondly the general condition of the patient is often poor and her muscles easily fatigued and this may be accentuated by a too early return to household duties with the added strain of nursing. The usual symptoms are an aching in the dorsi lumbar region often accompanied by a feeling of fatigue and tenderness over the muscles. The discomfort is worse on prolonged standing and is at first relieved by rest but later on ordinary or intermittent rest is inadequate and the ache becomes constant. The fatigued muscles allow their load to be transmitted directly to the joints around which they act. The ligaments of these joints become unduly stretched and this gives rise to localised tenderness and pain often of a burning character over the joint (lumbo sacral or sacro iliac). In these joints even articular or bony changes may ensue. The pain is then always localised to the area involved and radiates chiefly along the back of the thigh.

Treatment should include that of the general condition relief from overwork adequate rest possibly with change of air iron and general tonics. In some cases a corset wide enough to support the pelvic articulations or well adjusted strapping may give great relief. Physical therapy including massage and graduated exercises is usually advisable and may indeed be necessary before

a cure can be effected. If bony changes are suspected X ray examination of the lumbo sacral region should be undertaken in order to exclude them. In the more severe cases Hauser advises rest with extension till muscular spasm has subsided.

(4) *Traumatic Backache* This is due to trauma during labour. Attention has been recently directed to its importance and frequency by Shafiroff and Sava, who state that of 63 women coming to their gynecological clinic, and complaining of backache, 22 were definitely of a traumatic nature with onset of symptoms after pregnancy. All had received a general anæsthetic while in the lithotomy position, and first felt the backache on discharge from hospital. These patients are, they consider really suffering from untreated traumatic backache, caused by injury to, or subluxation of, the 4th or 5th lumbar vertebra. In 17 of the 22 there were osteo arthritic changes in one or other of these joints.

Diagnosis will depend on the history clinical features and the results of X ray examination. Backache due to pathological changes in the joints is always localised to the area involved and the pain radiates along the back of the thigh and leg.

Treatment In the milder cases a pelvic support wide enough to embrace the pelvis may be sufficient. This may consist of an elastic corset or strapping. In more severe cases and especially when there are osteo arthritic changes, rest in the recumbent position may be necessary until the inflammatory lesions have subsided, and should be followed by massage and graduated exercises. In hospital practice such patients will usually be referred to the orthopædic department for investigation and treatment.

(5) *Spondylolisthesis*, a condition in which there is slipping of the 4th or 5th lumbar vertebra or both forwards, is a rare cause of backache. The pain may first come on, or may be worse after parturition, as the displacement tends to be aggravated by the lordosis of pregnancy. There is a dull aching pain in the lumbar region, radiating to the lower extremities, increased by prolonged standing and relieved by rest. The trunk appears to be shortened because, owing to the slipping forward of the vertebra, the spine is more or less telescoped into the pelvis. This produces a transverse skin furrow encircling the trunk in the region of the loins. The diagnosis cannot be further discussed here, but those interested will find the subject fully treated in Mercer's paper.

(6) *Sacralisation of the last lumbar vertebra* has been mentioned on p. 422 as a cause of backache during pregnancy. The backache

often persists after delivery. Relief may be afforded by a corset or by strapping in addition to rest and general tonics.

Stress Incontinence This condition is often caused by purely mechanical factors, of which the chief is laxity of the pelvic floor, in other words weakness of the levator ani muscle. Such a complication is both avoidable and, once it has occurred, curable. Even years later stress incontinence usually responds well to treatment on the lines set out below. This is the method used at University College Hospital by Miss Cyriax, of the Department of Physiotherapy.

THE CYRIAX METHOD OF TREATMENT OF STRESS INCONTINENCE

Prophylaxis Exercises are given with the following objects in view —

1 To strengthen the levator ani muscle

Position	Exercise	Description
*Crook lying with the sacrum raised from the bed	Knee adduction against resistance	The patient parts her knees and then brings them together against resistance. This is best applied by an assistant who places her hands on the inner side of the patient's knees. As the strength of the muscle increases so does the resistance. An alternative but less effective form of resistance may be used in the absence of an assistant, the patient places a hard cushion between her knees and presses against it.

2 To strengthen the gluteal and anal muscles

Position	Exercise	Description
Lying on the back	Active contraction of the buttocks	

3 To strengthen the rectus abdominis muscle

Position	Exercise	Description
Lying on the back	Leg raising	The patient lifts both legs together off the bed keeping the knees straight. At first help should be given by the assistant who places one hand under the patient's heels and if there is divergence of the recti the other on the abdomen to hold the muscles together.

4 To raise the viscera especially the colon

Position	Exercise	Description
(a) Lying on the back with the arms above the head	Active visceral lifting	The patient breathes in and at the same time tries to draw the viscera upwards to the diaphragm. The exercise is more effective if the pelvis is fixed by an assistant.

* Crook lying. By this is meant that the patient lies at ease with hips and knees slightly flexed and soles of feet on the bed.

<i>Position</i>	<i>Exercise</i>	<i>Description</i>
* (b) Stretch stride standing	Trunk bending forward a little and then well back	The patient, in a good standing position, first draws the viscera up as in the previous exercise, and then, maintaining this position, bends a little way forward and then well back. The arms should be lowered before the exercise is repeated

5 *To strengthen the oblique muscles of the abdomen*

<i>Position</i>	<i>Exercise</i>	<i>Description</i>
† (a) Head rest, stride standing	Trunk rotation to right and left alternately	Keeping the pelvis still the patient turns as far as possible first to the right and then to the left
(b) Head rest, stride standing.	Trunk flexion to right and left alternately	The patient bends first to the right and then to the left taking care to keep the movement a pure flexion not as so often happens half rotation

* *Stride standing* Standing with feet wide apart

† *Head rest* Standing with hands on top of head

When standing exercises are performed, a good posture must be achieved before any movement is begun, *i.e.* the abdominal and gluteal muscles are contracted, the chest lifted and the head well poised. The breath must not be held. As the movement is begun, inspiration must take place, and expiration occurs as the movement ends.

When the exercises are given as a prophylactic measure Nos 1-4a should be begun on the first day after delivery, and the others as soon as the patient is allowed up. Each exercise is repeated 3 to 6 times and a short rest should be given between each.

Treatment When stress incontinence has been established for some time, the exercises that strengthen the levator ani muscle must be carried out assiduously. Particular care should be taken to ensure that the patient's buttocks are raised from the bed and that this is done by a pelvic tilt which raises the sacrum only, not the lumbar spine. If the latter leaves the bed the erector spinae muscle must have come into play to extend the spine and therefore the abdominal muscles must relax. The resistance given to the movement should be firm but not strong enough to exhaust the patient.

Results The tendency to incontinence diminishes within a few weeks. Depending on the degree of weakness of the pelvic floor and the length of time that the condition has existed, full relief may be expected in from six to twelve weeks in the majority of cases.

Epimenorrhagia or Polymenorrhœa In this condition, which is a not infrequent sequel of normal delivery, there is excessive and too frequent menstruation. If the loss is very great the patient may become considerably debilitated, especially just after her periods and there may be in consequence marked secondary anæmia. Fortunately, though the disorder may exist for several years *menstruation in the end tends to become normal*. Little or nothing is known regarding its ætiology, but it may have to do with a persistence of the slight hyperactivity of the thyroid gland that is characteristic of pregnancy. In support of this view we have noted that the patient is often thin and nervous and in a recent case of ours there was slight exophthalmos.

In another group of cases the cause is *metropathia hæmorrhagica*. This condition is dealt with in gynecological text books, and will not be further discussed here.

Treatment in the first group is unsatisfactory. Rest during the periods helps to diminish the quantity of blood lost, and if there is anæmia iron should be given intensively between the periods. Calcium lactate should also be given in doses of 15 grains thrice daily. We have not found either curettage or the administration of ergot to be beneficial. Although it is impossible to find any theoretical justification for it, progestin or proluton in large daily doses has been a great deal used and improvement, though often temporary, has been reported. If there is any suspicion of hyperthyroidism the patient should be treated from that point of view by abundant rest (not necessarily in bed) freedom from worry and excitement, sedatives such as bromides and possibly by Lugol's iodine, 5 to 10 drops of which should be given three times daily for a week or ten days before the period. If the patient is approaching the menopause, and the menstrual bleeding sufficiently severe to justify a treatment so drastic, *intra uterine radium* may be administered in sufficiently large doses (usually about 3 000 to 3 500 milligram hours of radium element) to produce permanent amenorrhœa. As an alternative hysterectomy may be carried out, leaving one or both ovaries. This has the great advantage over radium that the *symptoms attendant on an artificial menopause* are avoided. Small doses of radium, sufficient only to bring about a temporary amenorrhœa, should never be used, as there is a possibility that any child born later may be microcephalic, or in some other respect abnormal.

Follow-up of various Complications of Pregnancy and the

Puerperium On previous pages is discussed the prognosis of various complications of pregnancy and the puerperium such as pre-eclamptic toxæmia and eclampsia, pyelitis, diabetes, heart disease, tuberculosis, reproductive insanity, epilepsy, etc. To these sections the reader is referred. The great importance of following up after delivery patients who have suffered from one or other of these disorders is evident, and the postnatal clinic affords an excellent opportunity for doing so. In some of them further pregnancy may be inadvisable, at least for a time, and it may be well to offer contraceptive advice.

Return Visits. The patient should be given a definite date for her return visits. This is better than merely telling her to return in three months or six months, as the case may be. Suitable intervals are six weeks after delivery, three months after the first visit, and six months after the second, when if all is well she may be discharged permanently. Of course, if there is any pathological condition to be treated, such as cervicitis, backache, prolapse or retroversion, more frequent visits may be necessary.

REFERENCES

- BLAIR BELL, W. *Lancet*, 1931, i, 1171 and 1279
 BOURNE, ALECK, BOND L. T. and MCGARRITY, K. A. *Brit Med Jour* 1937, i, 116.
 FULFORDSON, *Am Jour Obst and Gyn* 1928 16 343
 GOFF, B. *Am Jour Obst and Gyn*, 1928, 16, 440
 HAUSER EMIL D. W. *S G O*, 1933 57, 380
 KENNY, MÆAVE. *Lancet*, 1937 i 14
 LYNCH, F. W. *Am Jour Obst and Gyn*, 1922, 4 362
 MATTERS, R. F. "The Cervix Uteri" The Hassell Press, Adelaide, 1935
 MERCER, WALTER. *Edin Med Jour*, 1936 N S iv, 43, 545
 MILLER, DOUGLAS. *Brit Med Jour* 1928 i, 717
 PEMBERTON, F. A., and SMITH G. VAN S. *Am Jour Obst and Gyn*, 1929 17, 165
 SHAPIROFF, B. G. P., and SAYA V. V. *New York State Jour of Med*, 1935, 35, 722
 SMITH, G. V., SMITHWICK, R. H. and ROGERS H. *Am Jour Obst and Gyn*, 1928, 15, 637

APPENDIX A

U. C. H.

OBSTETRIC UNIT.

Form 3.

ANTENATAL RECORD

In patient No		Antenatal No	
Name	Age	Date	
Address	Name and Address of friend		
Date of marriage			
Menstrual history			
First and last day of L.M.P	Estimated date of delivery		
Date of fertile intercourse if on one occasion only			
Was a calendar kept? (If so try to procure it and affix to this record)...			
Arrangements for confinement At home		In hospital	
Family history (T B, multiple births, health of parents and other near relations and cause of death)			
Personal history (Rickets, tubercle, rheumatism, sore throats, scarlet fever, diphtheria, heart disease, kidney trouble, operations, etc.)			
History of present pregnancy			
Vomiting		Headache	
Swelling		Constipation	
		Other conditions	

HISTORY OF PREVIOUS PREGNANCIES AND LABOURS

[illegible]

First Examination

	Date	Made by
General Nutrition	Stout thin average			Height	Weight
DIGESTIVE SYSTEM	Teeth				Other abnormalities
CIRCULATORY SYSTEM	Heart				Blood pressure
	Anæmia (blood count and H B estimation if anæmic)				
	Edema.				Other abnormalities
	Varicose veins				
NERVOUS SYSTEM	Pain tingling numbness (state site)				
	Other abnormalities				
DUCTLESS GLANDS	Abnormal distribution of hair				
	Other abnormalities				
RESPIRATORY SYSTEM	Lungs				Other abnormalities
SKELETAL SYSTEM	Evidence of rickets				Other abnormalities
URINARY SYSTEM	Frequency				Remarks
	Pain.				
	Urine { Reaction.				Albumin *
					S gar
WASSERMANN'S TEST	Date				Result

OBSTETRICAL EXAMINATION

Breasts ..			Nipples	
ABDOMEN	Height of fundus in weeks	...	Presentation and position	
Presenting part	Above brim engaging engaged		Fœtal heart sounds (point of maximum intensity)	

PELVIC MEASUREMENTS

Interspinous ..			External conjugate	
Intercristal ..			Diagonal conjugate	
Transverse outlet			Estimated true conjugate	
Pubic arch.			Type of pelvis	+
X ray	..			

Vaginal discharge	Date	...	Result of smears	...	Urethra.	Cervix.	...
C.D Test	Date		Result.

* If Albumin is present a catheter specimen must be taken and only the result of that entered

APPENDIX B

OBSTETRIC UNIT.

Form 8.

U. C. H.

DISCHARGE FORM

In Patient No

Name

Nature of Case (give essential details)

--

Date of Admission

Date of Delivery

Date of Discharge

No. of days in Hospital

MOTHER

General State

Uterus.

Position.

Involution

{ Anteverted Pessary
{ Retroverted
{ Satisfactory
{ Unsatisfactory

Appendages.

Perineum

Urine. (If patient has had albuminuria a catheter specimen must be examined and the result recorded here)

Blood Pressure

Remarks.

Medicines Prescribed

To Return for Examination.

CHILD

Birth Weight

Weight on Discharge ..

General Condition ..

Eyes ..

Navel ..

Method of Feeding ..

Signature of House Surgeon.. ..

APPENDIX C

U.G.H.

OBSTETRIC UNIT
(Post Natal Record).

Form 9

Name _____ Date _____ Age of child _____

Discharge at present time, and character _____

Duration of Red lochia _____

Menstruation _____

Discomfort ⁸ _____

Pain, site, character etc. _____

Backache _____

Beating down _____

Bladder Frequency _____ day _____ night _____ Incontinence _____

Urine _____ B.P. _____

Bowels _____

Breasts _____

Breast feeding _____ Artificial feeding _____

(When started _____
Kind _____)

EXAMINATION

General condition _____ Good _____ Fair _____ Poor _____ Anxious _____

Abdomen (striae &c.) _____

Vulva gaping, Normal _____

Perineum deficient, adequate _____

Laceration _____

Escape of urine on coughing _____

Cystocele _____ Rectocele _____

Cervix Descent _____

Patency _____

Tear _____ Situation _____ Degree-severe-slight _____

Cervical _____ Degree-severe-slight _____ (make sketch) _____

Uterus Size _____ Involution complete incomplete _____

Position _____ tenderness _____

Other abnormalities _____

Appendages Right _____ Left _____

Cervix per speculum (to be exposed at least once in every case) _____

Further remarks on general or local condition _____

Treatment _____

Return on _____

Patients should be seen at least 3 times at the Post-Natal Clinic, viz. 6 weeks after delivery
3 months after the first visit, and 6 months after the second.

For Return Visits a blank page will be found on the reverse side.

APPENDIX D

MEDICINAL INDUCTION OF LABOUR

The following is the routine employed in University College Hospital

Castor oil 2 oz at 5 p.m.

Hot bath at 4.30 p.m.

Enema, 9 p.m.

Pituitary extract (2 units in each dose) at half hourly intervals commencing at 10 a.m. next day and repeated till 6 doses are given. This is one full course.

If labour pains do not start, the treatment is repeated again after twenty four hours. The onset of pains is not sufficient indication for stopping the injections. They should be continued till the cervix begins to open and the membranes to bulge, else the pains may cease when the injections are stopped.

When drug induction is used as a preliminary to a trial labour the above routine is modified as follows.

(a) No hot bath is given as there is some risk of the vagina being infected by the bath water. A kneeling bath is given instead or the patient is sponged while sitting on a board laid across the bath.

(b) Pituitary extract is omitted entirely as there is disproportion, and consequently a risk of rupture of the uterus should the pituitary extract cause strong contractions.

Medicinal induction is a very satisfactory and successful method if the patient is at term or postmature, and especially if the head is deeply engaged in the pelvis.

It is less successful when used for induction of premature labour and the chances of success are in inverse ratio to the degree of prematurity. Before the end of the thirty sixth week of pregnancy the prospects of success are small, though we have known it succeed at the thirty second week.

Time taken to start labour

In a series of cases reported by me in 1922 the average time elapsing before the onset of labour pains, and counting from the first dose of quinine, which was routine at that time was twenty nine hours. The majority of the patients were at term or postmature but about one-third were premature.

Contraindications to the use of pituitary extract

As stated above, pituitary extract should be omitted from the course if there is any suspicion of disproportion between the head and the pelvis on account of the danger of rupture of the uterus.

APPENDIX E

HINTS TO EXPECTANT MOTHERS*

Diet Plain, easily digested food should be taken, especially in the last three months. At least 1 pint of milk should be taken daily, including that in puddings, tea, etc. Fresh fruit (apples, oranges, grape fruit), fresh green salads (lettuce, cress, etc.), eggs, butter and fish (fresh herring is one of the best).

Exercise Aim at having at least one hour in the open air each day. Avoid getting overtired.

Rest Try to rest for two hours in the afternoons with your feet up, especially in the last three months.

Sleep Try to get at least 8 hours sleep each night. Sleep with windows open.

Teeth If any are decayed, see a dentist as soon as possible. Brush the teeth regularly night and morning, using baking soda, table salt, or any good tooth powder.

Breasts The nipples should be washed every day with soap and water and rubbed dry with a rough towel. Draw the nipples out each day with the finger and thumb. This prevents much pain and trouble from 'cracking' of the nipples while suckling.

Constipation The bowels should act freely each morning after breakfast. Eat wholemeal bread and plenty of fruit. Stewed prunes are specially useful. If necessary, take senna tea or a vegetable laxative tablet each night. Senna tea is made by putting 10-15 senna pods in a tumbler and pouring cold water over them. Allow the 'tea' to stand for 12 hours before drinking.

Heartburn Avoid greasy and fried foods. Sip a glass of hot water in which half a teaspoonful of baking soda is dissolved, or swallow 2 or 3 soda mint tablets.

Varicose Veins Avoid garters. Crepe bandages put on before getting up are useful as a support. Rest for at least two hours during the day with the feet up and the clothes loosened.

Marital Relations These should be entirely avoided during the last three months of pregnancy.

Drugs Never be tempted to take drugs to 'bring on a period'. Those pills and medicines which are secretly sold to pregnant women seldom act except when taken in poisonous doses.

DANGER SIGNALS

If any of the following symptoms appear, consult a doctor at once —

Headaches Especially if they are frequent or persistent.

Pain over the stomach

Giddiness or fainting

Dimness or any trouble with sight

Swelling of hands, face, feet or legs

Bleeding This should never occur during pregnancy. It is almost always a serious symptom. It is best to go to bed and send for a doctor.

* Leaflet issued to expectant mothers on first booking in for confinement.

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